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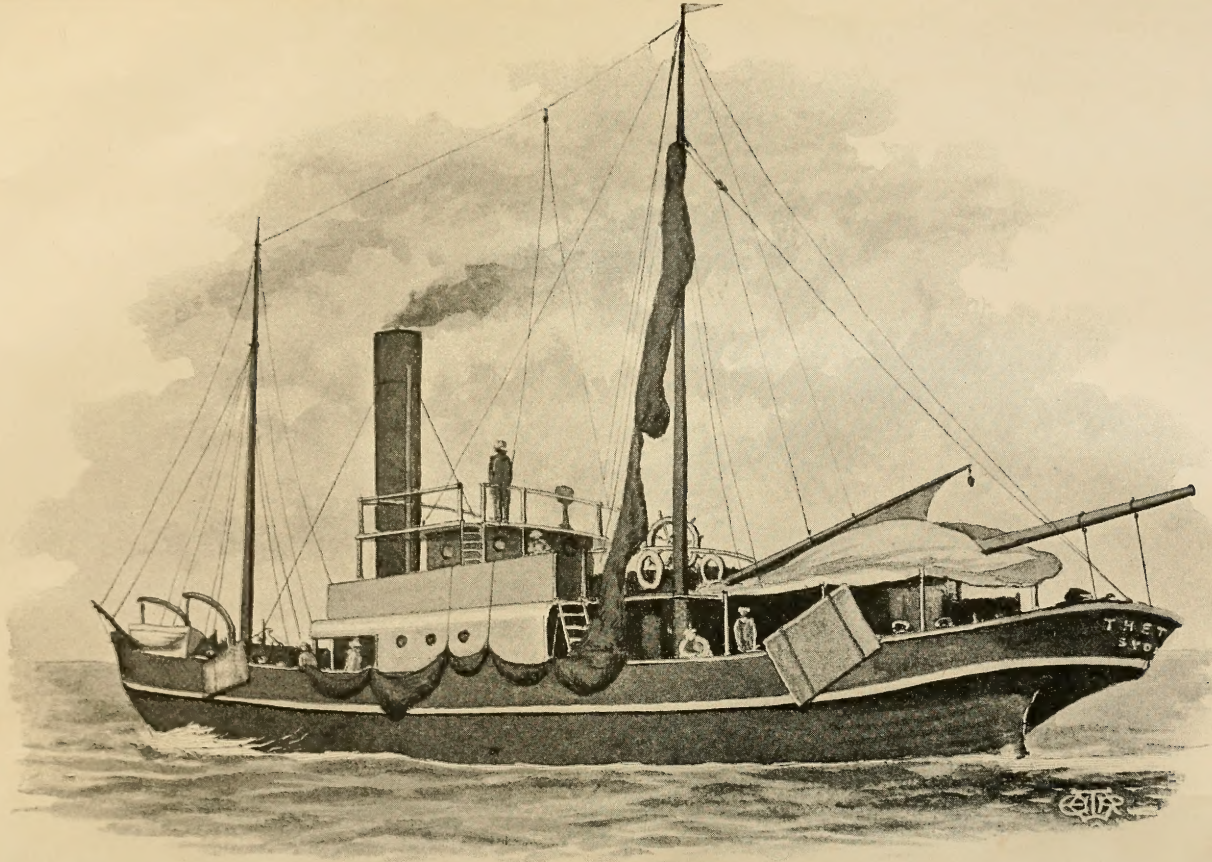

H. M. C. S. "THETIS."

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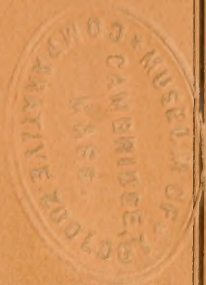

SCIENTIFIC RESULTS

OF THE

TRAWLING EXPEDITION

OF

H.M.C.S. "THETIS,"

OFF THE COAST OF NEW SOUTH WALES,

IN

FEBRUARY AND MARCH, 1898.

PART 1.—Published 23rd December, 1899.

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PUBLICATIONS OF THE AUSTRALIAN MUSEUM.

JUNE, 1898.

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2. Catalogue of Mammalia in the Collection of the Australian Museum, by G. Krefft, 1864. 12 mo. pp. 133. (Out of print.)

3. Catalogue of the Minerals and Rocks in the Collection of the Australian Museum, by G. Krefft. 1873. 8vo. pp. xvii.-115. (Out of print.)

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11. Descriptive Catalogue of the Medusæ of the Australian Seas. Part I. Scyphomedusæ. Part II. Hydromedusæ, by R. von Lendenfeld. 1887. 8vo. pp. 32 and 49.

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SCIENTIFIC RESULTS OF THE TRAWLING EXPEDITION OF H.M.C.S. "THETIS."

INTRODUCTION.

By EDGAR R. WAITE, F.L.S.,
Zoologist, Australian Museum.

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INTRODUCTION.

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Zoologist, Australian Museum.

South of the equator, few waters, if any, have been as thoroughly investigated as those of Port Jackson, and it has been proved that its fauna is an extremely rich one.

On the other hand, the fauna of the waters which break upon the Australian coasts as a whole has been but little examined, and while the seas of New South Wales have been better searched than those of any other part of the Continent, it needs but the slightest dip into our literature to become aware that such investigations have, for the greater part, been made immediately outside Port Jackson.

The only observations made in our coastal waters for scientific purposes have resulted from the visits of foreign equipped expeditions making Sydney a port of call. All local ventures have had a commercial basis, that is, they have been made in connection with the fishing industry, and even these are very limited in number, and for some reason or other so unsuccessful, that to-day not a single boat is engaged in trawling.

It is constantly remarked that trawling can never be a commercial success here, because either the fish cannot be obtained in payable quantities, or those taken are not of sufficient quality for table use. It is not my purpose to discuss this aspect of the question, but I would pertinently point out that we know practically nothing of the habits of the fish we wish to secure, and that small chance of supplying the deficiency exists until we have established a Biological Research Station with necessary corollaries. Many of the countries of Europe, and America, richly endow such institutions, and one need but look to the publications of their staffs to realise the amount of valuable work accomplished. To those interested I would recommend a perusal of the admirable work by Mr. J. T. Cunningham, M.A., published by the Marine Biological Association.*

Another cause of failure may be traced to the haphazard manner in which the experiments have been conducted. No complete submarine survey has been made, but in September and October,

* Cunningham—Marketable Marine Fishes, 1896.

1892, Staff Commander Fred. Howard, R.N., made four hundred and three soundings off the coast, ranging from 10 to 128 fathoms. Rarely has a trained naturalist been employed, and in the few instances where the services of such has been sought, he has never been consulted as to necessary equipment or permitted any voice in the direction or control of the expedition, but been placed on board to accept matters just as he may have found them.

I have below given a rapid sketch of the marine investigations of the Colony, and some idea of the paucity of such operations will be thereby gained. In very few cases has any scientific or other record been kept, but such as I have traced, while scanning the literature, is chronicled or the necessary references supplied.

Shore collections had been previously made, but one of the earliest investigators to obtain specimens below tide marks was Samuel Stutchbury, afterwards Government Geologist of New South Wales. He was the first to take alive the interesting mollusc *Trigonia*, the species previously obtained in Tasmania by Peron and King being known from the shell only. Stutchbury describes* how certain specimens were attached to *Trigonia*, and, "having seen the living animal," discusses its zoological position. *Trigonia* was probably first taken here in 1826, for on p. 98 of the work quoted, Stutchbury records having in the year 1286 *(sic)* searched near the entrance of Port Jackson and discovered, among other forms, the first living *Clavagella*.

We have evidence that the first *Trigonia* was actually dredged, for A. H. Cooke, dealing with the leaping powers of Mollusca, writes† "Miss Saul has informed me that the first living specimen of *Trigonia* that was ever obtained was lost in a similar way. It was dredged by Mr. Stutchbury in Sydney Harbour and placed on the thwart of a small boat. He had just remarked to a companion that it must be a *Trigonia*, and his companion had laughed at the idea, reminding him that all known *Trigonia* were fossil, when the shell in question baffled their efforts to discover its generic position by suddenly leaping into the sea, and it was three months before Mr. Stutchbury succeeded in obtaining another." This account is an extension of that appearing in the Bridgewater Treatise.‡

The "Astrolabe," flying the French flag, during her voyage in 1826-29 visited New South Wales and made dredgings in Jervis Bay and Port Jackson. Quoy and Gaimard were the naturalists on board, but they did not collect *Trigonia* in Port Jackson. Everyone who afterwards visited Sydney seems to have been determined

* Stutchbury—Zool. Journ., v., 1830, p. 97.

† Cooke—Cambridge Natural History, iii., 1895, p. 65.

‡ Bridgewater Treatise, i., 1835, p. 264, pl. v., fig. 5.

to obtain this pretty shell, and so well did they succeed that it is now almost exterminated from its old haunts; the species, *T. lamarcki*, however, also occurs in deeper water outside the harbour, and examples were obtained by the "Thetis." The collections made by the "Astrolabe" have been fully examined and the results published. Many interesting observations on the fauna of the coast are recorded.*

H.M.S. "Fly," together with her tender the "Bramble," was in Sydney several times between 1842 and 1845 refitting for her surveying cruise. She also put in at Port Stephens, but it is not clear if she dredged in our waters. The specimens obtained may have been collected at low tide. A crustacean, *Xantho deplanatus*, White, is described from Garden Island, Port Jackson.†

The surveying work of the "Fly" was continued by H.M.S. "Rattlesnake," and in the years 1848 and 1849 she also took in supplies at Sydney. Several dredgings were made, principally in Bass and Torres Straits, but specimens are also recorded from Port Jackson and Jervis Bay.‡ At Cape Byron, an immature Gasteropod was taken and afterwards named by Gray *Macgillivrayia pelagica*.§

In 1857 H.M.S. "Herald" visited our waters, and in April of that year dredged off Port Stephens and Cape Three Points in 70-80 fathoms. Of Mollusca obtained may be mentioned *Pleurotoma suavis*, Smith,‖ and of Polyzoa *Lunulites crassa*, Tenison Woods, *L. angulopora*, Tenison Woods, and species of *Selenaria*.¶ I am not aware of any collected results of this early expedition of the "Herald"; the material was scattered, some Mollusca going to London, while the Polyzoa remained at the Macleay Museum in Sydney. It was evidently taken charge of by Mr. W. S. Macleay, who, as is apparent from the latter work quoted, was on board when the dredgings were made.

The following year, or thereabouts, the Austrian frigate "Novara" called at Sydney during her voyage round the world in 1857-9, and made collections in our waters. The results of the expedition were published in Vienna.**

When H.M.S. "Challenger" visited Australia in 1874, the trawl was put down several times off New South Wales, and many

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* Voyage de l' "Astrolabe," iv., 1833, pp. 323-4.

† Voyage H.M.S. "Fly," ii., 1847, p. 337. See also Appendix.

‡ Voyage H.M.S. "Rattlesnake," ii., 1852, App., pp. 368-374.

§ *Loc. cit.*, i., p. 45.

‖ Smith—Ann. Mag. Nat. Hist. (6), ii., 1888, p. 305.

¶ Tenison Woods—Trans. Roy. Soc. S.A., iii., 1880, pp. 5, 7, 9.

** Reise der Osterreichschen Fregatte Novara, 1869.

soundings were taken. On April 4th, while off Twofold Bay (Station 163A.) trawlings were made in 120-150 fathoms with very satisfactory results.* Of this haul Prof. H. N. Moseley wrote:— "For the first time we procured enough fish to allow of our eating them." The "Challenger" remained at Port Jackson from April 6th to June 12th, 1874, and on June 3rd the trawl and dredge were lowered several times in 30-40 fathoms (Station 163B.). During the stay many dredgings were made within the harbour, and the long list of material obtained is published where cited.†

During the voyage of S.M.S. "Gazelle," 1874-76, numerous specimens were obtained on the east coast of Australia, but there the operations appear to have been confined to Queensland waters. The results have not appeared in collected form, but papers on the Madreporaria, ‡ Alcyonaria,§ Pycnogonida,‖ Pteropoda,¶ Echinoidea,** and Mollusca†† have been published.

From January 23rd to April 15th, 1881, H.M.S. "Alert" was refitting in Sydney Harbour, whence she proceeded northward in continuation of her cruise. Although many dredgings were made in Port Jackson, nothing seems to have been done outside until the Queensland coast was reached. The results have been published in book form.‡‡

Of local enterprise there is very little to be said, the experiments are not numerous, and except in a few isolated instances no records have been preserved.

The pioneer of the movement in New South Wales seems to have been Sir William Denison, then Governor of the Colony, and the following account I clip from a letter by Capt. Francis Hickson, R.N., published in the daily press §§:—

"In or about the year 1857 a small fishing craft said to hail from the Mauritius arrived in Sydney Harbour with a trawl on board, and the man in charge reported that they had netted such a quantity of turbot on the coast near Sydney that their net broke. He could not, however, produce a single specimen of this much-prized fish.

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* Challenger Reports—Summary of Results, i., 1895, p. 546.

† Challenger Reports—*loc. cit.*, p. 552-574.

‡ Monatsb. K. Preus. Akad. Wiss. Berlin, 1877, p. 625, and 1878, p. 524.

§ Studer—*l.c.*, 1878, p. 632.

‖ Böhm—*l.c.*, 1879, p. 170.

¶ Pfeffer—*l.c.*, 1879, p. 230.

** Studer—*l.c.*, 1880, p. 861.

†† Martens—Conch. Mittheil, ii., 1881, p. 105; Sitsb. Ges. Nat. Freunde Berlin, 1881, p. 66.

‡‡ Report Zool. Coll. "Alert," 1884.

§§ "*Sydney Morning Herald*," 6th March, 1897.

"The man's report created such interest, however, as to induce His Excellency the late Sir William Denison, Sir Daniel Cooper, and Captain Broomfield, who is still to the fore in any enterprise of the sort, to take the matter up, and two unsuccessful attempts, under the supervision of the last named gentleman, who insisted on being on board the vessel to test the *bona fides* of the affair, were made in the new arrival.

"It became perfectly manifest that our visitor wanted to sell his plant to the best advantage. The scheme failed, however, and he was only enabled to sell his trawl; this was purchased by Sir William and Sir Daniel. After having secured the trawl, which was an ordinary North Sea one, with a beam of about 30ft., the owners, together with Captain Broomfield in the schooner 'Gazelle,' tried Botany Bay and secured a few flounders, but no sign of turbot.

"I now come upon the scene, as I was sent, with a party of men from H.M.S. 'Herald,' to follow the matter up and ascertain whether there was any foundation for the report which had been circulated, and to try the trawling capabilities of the coast generally. We embarked in the schooner 'Catherine Agnes,' accompanied by Captain Broomfield, the owner, who had gratuitously placed his vessel at our disposal. The late Mr. E. S. Hill, a most experienced fisherman and amateur naturalist, also joined the party.

"We trawled in the North Harbour, also in Jervis Bay, and at the most likely spots along the coast between Sydney and the before-mentioned place. We met with various vicissitudes in the way of fouling the trawl, breaking the beam, having to bear up for an anchorage to cut a fresh one, and so on, and we continued our efforts about ten days. We caught a few sole, john dory, and flathead, with plenty of blubber, and other refuse; but there was no sign of turbot, and we were not favourably impressed with the trawling capabilities of the coast."

Nothing further appears to have been done until 1874, when on November 28th Sir (then the Hon.) Wm. Macleay sent the schooner "Peahen" on a dredging expedition to Port Stephens. Beyond the fact that a large Sunfish was found stranded on the beach and removed to Sydney, I have no details; the only published notice seems to be: "Mr. Brazier read an amusing account of a dredging excursion along the coast of New South Wales."*

In November, 1880, the Australian Museum chartered the S.S. "Manly," and instituted a dredging excursion to Port Stephens and Broughton Island. The Invertebrates obtained numbered

* Proc. Linn. Soc. N.S.W., i., 1877, p. 14.

about seven hundred, the Crustacea were determined by Haswell, the Mollusca by Brazier, and a list of the collections will be found in the Report of the Trustees.*

The Fishery Commissioners of New South Wales next commenced operations with a beam trawl. Their first essay was made in the S.S. "Dove," and the ground covered extended from Jervis Bay to Botany Bay. This vessel was in trawling service from October 22nd to 27th, 1883, and a narrative of the expedition may be consulted in the Commissioner's Report † A more technical account was prepared by Macleay,‡ and although not quite correct as to dates is of considerably more interest—two new species of fishes, *Lepidotrigla mulhalli* and *Raja australis* are described, and others mentioned. The Invertebrata obtained do not appear to have been preserved.

In February, 1884, the Commissioners obtained the use of H.M.C.S. "Ajax," and, again with a beam, trawled off the coast. From one of the Inspector's Reports, kindly lent me by Mr. J. A. Brodie, Chief Inspector of Fisheries, I gather that the first trial was made south of Port Jackson in 45 fathoms, but proved a failure; it was next lowered in 50 fathoms, and after a run of ten miles the fish caught were "dory, nannygai, flathead, sting rays, saw fish, and leather jacket."

Steaming northward the trawl was next day shot in 25 fathoms off Cape Three Points, and raised in 30 fathoms over a ten mile course; the fish were similar to the last haul, but in greater quantity. The next essay proved a blank; and of the concluding trial, off Bird Island, in 25 fathoms, the Inspector writes:—"When we hove the trawl up it was torn to ribbons, evidence of it being done by red coral reefs, as pieces of red coral were brought up with the remains of the trawl." This is the only bit of information obtainable of the Invertebrata; what the Inspector mistook for red coral was doubtless the Hydrocoralline, *Stylaster sanguineus*, obtained by the "Thetis," but never before recorded from this Colony, its habitat being vaguely rendered as "Australia."

The waters of Port Jackson and other harbours are largely netted by Italians, chiefly from the Lipari Isles, of whom there is in Sydney a considerable number engaged in either the selling of fruit or catching of fish. Some of the leading members have attempted trawling on the Italian plan. Instead of working either the beam or otter trawl, they use the *Paranza*, dragged by two vessels.

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* Australian Museum Report for 1881 (1882), pp. 1 and 19.

† Report Commissioners of Fisheries N.S.W. for 1883-4, p. 33.

‡ Macleay—Proc. Linn. Soc. N.S.W., viii., 1884, p. 457.

In 1888 several such attempts were made in the interest of Dr. V. Marano, the Italian Consul, Mr. Oscar Meyer and Mr. Leonardi Porcelli; the dates supplied to me are June 3rd and 4th, 29th and 30th, July 7th and 8th, and 22nd and 23rd. Trials were made between the 25 and 33 fathoms lines, and the net used was one patented by Mr. Porcelli, of which the specification (and an illustration) is published by the Fishery Commissioners* :—

"The net itself is unlike the English beam trawl, being twice as long, and having its other dimensions in proportion; the mouth, instead of being a plain transverse opening, is formed of two extending jaws or wings, which when distended form a shape like the letter V. The net is drawn through the water by two vessels, there being two warps attached to it, one at each side of the mouth; the attachments also are different from those used with the ordinary English trawl." The trials were regarded as very satisfactory, and were conducted off Broken Bay and Port Hacking. One catch is described as being so enormous that the net broke, and the fish escaped.

Operations were renewed by the Italians in 1890, but no industry has resulted from the several praiseworthy attempts made.

In August, 1889, Mr. F. W. Smithers, Inspector of Fisheries, took out a small vessel, and put a trawl over in 17 fathoms off Merimbula, north of Twofold Bay; the Mollusca were sent to the Museum and determined by Brazier, who records seven species, the only one of special interest being *Crassatella kingicola*, Lamk., recorded for the first time from the coast of New South Wales.†

It was a constant practice, extending over many years, for the Australian Museum staff to dredge within the harbour, but operations finally ceased in 1893 when the financial crisis of the Colony occurred. The collections made have afforded material wherewith to furnish the galleries, and have also been used for purposes of exchange.

No account is here taken of the many dredgings in Port Jackson made by both foreign and local effort, and which have provided material for many papers published here and elsewhere. A list of the Mollusca taken in Port Jackson in one day may be consulted in the Annual Reports of the Trustees.‡ While as showing the richness of the fauna, Mr. A. U. Henn, in October, 1893, took an old bottle from a rock pool and found it to contain one hundred and fifty-five species of molluscs represented by one thousand three hundred and seventy-six specimens.§

* Report Commissioners of Fisheries N.S.W., for 1888, p. 19, and plate.

† Brazier—Proc. Linn. Soc. N.S.W. (2), iv., 1889, p. 745.

‡ Australian Museum Report for 1881 (1882), p. 16.

§ Henn & Brazier—Proc. Linn. Soc. N.S.W. (2), ix., 1894, p. 165.

We may thus close a brief notice of trawling and dredging on the coast up to 1898, in which year H.M.C.S. "Thetis" was commissioned. A report on the fishes of the expedition, hurriedly prepared for presentation to Parliament, has already appeared; in the following pages this will be referred to as the "Preliminary Report."*

For the inception and organisation of this expedition credit is due to Mr. Frank Farnell, M.L.A., who, in addition to being an ardent fisherman, enjoyed special facilities by virtue of his position as a member of the Legislative Assembly of New South Wales.

The expedition was financed by the Colonial Government and Mr. Farnell was appointed director; with him was associated Capt. Carl August Nielsen, an experienced North Sea trawler, on whose skill depended the successful working of the appliances.

When all arrangements were virtually completed it was decided to ask the Trustees of the Australian Museum to appoint one of their officers to join the expedition, chiefly to determine the fishes and write a report thereon. On the Curator's recommendation the writer was selected to act in this capacity, and I, in consequence, was aboard the vessel during the whole period and saw the trawl raised on every occasion. A large and valuable collection was preserved, particulars of which will be published as dealt with by members of the Museum Staff in subsequent pages.

Although I may have further need to refer to the following matter, I take this opportunity of emphasing the fact that the expedition was conducted purely in the interests of fishing industries, consequently neither the Trustees of the Museum, nor their representative, were consulted as to the equipment of the vessel or the area to be traversed. On one occasion Mr. Farnell kindly obliged me by re-trawling old ground when I hoped to secure further examples of the new *Chimæra*. Her Majesty's Colonial Steamer "Thetis," under the command of Capt. C. P. Hildebrand, was fitted up for the undertaking, but, as experience showed, was a most unsuitable vessel for the purpose. In addition to rolling heavily in even moderate seas, she carried a lot of top hamper, which left small space wherein to work. The amidships was occupied by the upper engine room, while the after deck was crowded with the donkey engines, the cabin skylight, companion, etc. The only clear space wherein one might have worked with some degree of comfort had been most unfortunately absorbed by the erection of a huge ice-house intended as a store-room for the fish obtained. The port gangway was given over to the working of the trawl, so that the little space that remained

* Sea Fisheries. Report Trawling Operations N.S.W., H. M. C. S. "Thetis," 1898.

was portion of the gangway on the starboard side, and, except when the trawl was being actually towed, this was frequently rendered an untenable position owing to the passage of the warps and ropes from the donkey engines.

Rolling and pitching is a condition inseparable from life at sea, but in a vessel specially equipped for scientific work the inconveniences are reduced to a minimum. In my case work had to be conducted on deck, and having no rackwork, all receptacles had to be lashed to stays and other deck furniture.

I mention these matters in order to show under what adverse conditions my work had to be conducted. On the other hand, I cannot speak too highly of the kindness shown to me by the officers and crew of the vessel, to whom at times my movements must have been troublesome, interfering somewhat with ship management.

Perhaps of all objects those which gave me most trouble were the long fingered Echinoderms (*Luidium*). Soon after being laid on deck these creatures and their long members parted company, and no amount of persuasion would induce them to remain in position. I next found that it was possible to kill the star fishes before separation took place by inverting them in a shallow dish and rapidly flooding them with the strongest spirits. The rhythmical roll of the vessel, however, caused the arms to sway from side to side until they broke away from the centrum as before. The difficulty was finally overcome by the construction of a cabinet containing shelves. After being killed, each specimen was transferred to one of the trays and pinned into position, and thus safely conveyed to port at the first opportunity.

A constant source of annoyance were the Squids; in company with fish and other specimens the net would sometimes yield them by bucketsful; when voiding their secretion (sepia) the whole became a blackened mass. In this connection one matter may be worth mentioning: for the first week, or thereabouts, my hands were black from this cause, and no amount of washing would remove the stain. This disappeared naturally after a time, and thenceforward the sepia had no effect on the hands whatever. Whether this resulted from a counteracting effect of fish mucous or not I cannot say.

TRAWL.

The type used was that known as the Otter Trawl, wherein the mouth of the net is kept distended by means of two large boards —the otters. Our trawler, Captain Nielsen, had introduced some improvements on the usual type of otter trawl, but such need not be referred to here. It may, however, be mentioned

that, in place of the usual single warp, two were used, and the advantage of this was on one occasion clearly demonstrated. At Station 13 the forward warp broke, notwithstanding the fact that it was composed of the best wire-rope, an inch in diameter. Had the net not been held by a second warp, we should have lost everything—an experience not new to me. This double warp does away with the necessity of a bridle, and, had we been able to pay it out over the stern instead of the port side, its advantages would have been still further increased. In working an otter trawl at varying depths some nice adjustment is necessary to ensure the boards always running at the correct angle. In shallow water the warp paid out was about three times the indicated depth, but in deeper water the proportion was lessened in consequence of the greater weight of the warp. If hemp, instead of wire, had been used, much more rope would have been required.

The net being intended for economic and experimental purposes, the mesh was altogether too large to meet the requirements of a naturalist; near the mouth it was about five inches, and in consequence large quantities of fish escaped. Indeed, the first indication of a successful haul, from an economic standpoint, was the large number of Gurnards *(Triglidæ)* rising to the surface, belly upwards, and floating away astern. At the smaller end, the mesh was also large, consequently the smaller organisms among which a zoologist would expect to reap the richest harvest, were, for the most part, not obtained. When mud was freely encountered, our efforts were more successful, and it was on such occasions only that I was able to gather the more minute Invertebrate life. In such cases as much mud as possible was put through the filters of various gauges and a fair unwashed sample retained to be afterwards worked for microscopic forms. On several occasions when mud had without doubt been netted, all but a trace of it had been sifted out as the trawl passed through the water. With a view of retaining some of this mud, a canvas bag was attached to an iron hoop within the bunt end of the net and thus on several occasions the object was effected. As considerable trouble was entailed in securing and removing the bag, I did not care to try the good nature of our trawlers too frequently.

DREDGE.

I had hoped to largely supplement our takings by means of dredges specially designed for arresting the smaller organisms which the trawl was not calculated to retain. In this I was much disappointed. Having no appliances for running out a separate warp, the dredge had to be attached to the bunt or "cod-line" of

the trawl, and unfortunately the first time it was put over, rocks were encountered, and notwithstanding the fact that the frame was constructed of iron bars thicker than a broomstick, the appliance was broken and twisted out of all recognition. (Fig. 2, p. 23.) This in itself was a small matter, and the duplicate on hand could soon have been attached; it was, however, evident that the dredge had contributed so largely to the damage sustained by the trawl on that occasion, that I could not again think of subjecting it to similar undesirable possibilities.

TOW-NET.

Following our usual custom when working within Port Jackson, the tow-net was at first let out astern; owing, however, to the comparatively great speed at which we trawled—$2\frac{3}{4}$ to 3 knots—and especially in a choppy sea, or with the current against us, it was found that two men were required to haul the net in. This extra pressure, bringing the speed up to four, or even more knots, "started" the material, and eventually a net was lost owing to the breakage of the tow-line. In order to avoid this extra pressure, and also to dispense with the services of two ill-spared men, the following plan was tried and succeeded so well that it was ever afterwards adopted. A boom was run out for'ard from the upper deck and the tow-line passed to the quarter, where a tripping-line attached to the rim of the net enabled me to haul it up at any time single handed. (Fig. 1.)

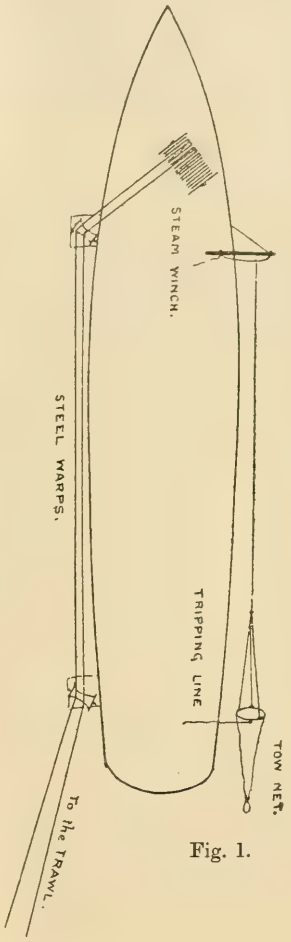

Fig. 1.

In fine, bright weather, a quarter-hour's run was sufficient to quite fill the bottle with *Salpa*, *Velella*, *Physalia*, *Medusa*, Pteropoda, and other pelagic forms.

When at anchor, I used a cane-rimmed net, much lighter material, and supported the neck of the bottle with corks; it was thus floated away by the current

or the wind, and although passing a much less quantity of water per minute, did good work.

The tow-net was also occasionally run at night, and the phosphorescent organisms, Copepoda, *Salpa*, etc., quite illuminated the bottle in which they were received. Every ripple on the water was also lighted with them, but not nearly so brilliantly as when concentrated in the bottle of the tow-net.

As the trawl was worked from the port side of the vessel, the tow-net was necessarily run from the starboard. While watching the trawl-warps small animals were often noticed floating by. Many of these were obtained by dropping a captive bucket overboard. In this way I got examples of *Ianthina*, and on one occasion, off Wata Mooli, at 5 p.m., March 12th, secured the only three examples of *Glaucus atlanticus* observed during the cruise.

PELAGIC LIFE.

The harvest of the tow net greatly astonished all on board, to whom pelagic life had an undreamed existence. When it was further pointed out that these surface organisms were directly or indirectly food for the fishes we were endeavouring to catch, those specially interested in the trawling venture viewed the proceedings with even keener attention.

As so little is popularly known on this subject, and as it has such great bearing on the fishing industry, I have been asked to devote a paragraph to pelagic life. Until the gatherings of the tow net have been systematically examined it is not possible to detail the various captures. A very good idea of this pelagic life may, however, be gleaned by periodic visits to our ocean beaches.

Working along the beaches in January, regular collectors note the comparative absence of surface life. In February, under suitable conditions, as the ripples recede from the sand, they leave behind a line of minute animal life; this pelagic life increases in volume until about May, when it reaches its maximum. After July this flux greatly diminishes.

On scooping up a little of this living line and placing it in a bottle of water, it is seen to consist of a great variety and infinite number of minute organisms. In greatest abundance are the jelly-like bodies known as *Salpa*, members of the Tunicata, transparent and almost invisible, while in water, to the human eye. Some of the larger species measure seven or eight inches in length and weigh several ounces. Also common are species of worms, *Sagitta*, likewise transparent. Scattered among these are many different kinds of Crustacea such as Amphipods, allied to the

familiar sand hoppers, Isopods, marine representatives of the garden woodlouse, and Copepods, all eagerly devoured by fishes. Of the shell-fish kind we observe *Ianthina*, *Glaucus*, and the Pteropods and Heteropods, in which the body is transparent and the shell almost obsolete. Numerous small *Medusa*, or jelly fishes, are also washed up, and if these are not actually eaten they form food for other creatures preyed upon by fishes. The *Physalia*, better known as the Portuguese Man-o'-war, is a familiar and abundant animal, dreaded for its stinging properties. Mr. T. Whitelegge tells me that he has often seen small fish in their stomachs and entangled in their tentacles. *Velella* is an allied animal frequently associated with *Physalia*. These are some of the principal pelagic types met with, but hosts of other forms also occur; some of these are quite erratic in their appearance. At times the waters off shore and in the harbour become greatly discoloured, and in places even present the appearance of blood. Mr. Whitelegge, who investigated this matter,* found that it is due to the presence of a small organism, *Glenodinium rubrum*, which swarms to such an extent as to discolour the water for miles and miles.

Organisms belonging to the same group are largely preyed upon by fishes, and there is little doubt that our *Glenodinium* is to be ranked as a bountiful supply directly or indirectly. MM. Pouchet and Guerne, who examined some sardines, found their viscera literally filled with species of *Peridinia*, and estimated that the digestive tract of a single fish contained no less than twenty million individuals.†

It is, however, difficult to give any idea of the wealth of minute life at the surface of the ocean; it is sometimes washed ashore in such profusion that the rocks become dangerously slippery with a thick deposit, whilst the water in the rock pools is thickened by the abundance of *Salpa* and other forms. Associated with them are crowds of Copepods. Every object in the water is peopled with them; shake a piece of seaweed in a bottle and thousands are disturbed; when dead they settle as a thick sediment.

It must be remembered that I am not writing of food in the sea generally, but only of that found at the surface. This surface life is much influenced by the weather; if a shower disturbs the surface the minute organisms sink, and then cease to be washed ashore. The sudden disappearance of a shoal of fish might be thus accounted for.

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* Whitelegge—Rec. Aust. Mus., i., 1891, pp. 144 and 179.

† Pouchet and Guerne—Comptes Rendus, 1887, p. 712.

The warm current of water which sets down the Australian coast from the north brings in its wake many forms not properly belonging to the fauna of our temperate shores. This current from the tropics is extremely rich in minute forms of animal life, consequently fishes are attracted to, and journey along with it. This current brings to us many tropical fishes such as *Nomeus*, *Schedophilus*, *Psenes*, *Monacanthus nitens*, and *M. filicauda*. A hitherto unrecorded equatorial species, may now be chronicled, Mr. Whitelegge having at Maroubra Bay secured examples of *Chætodon citrinellus*, Brouss. One sign of this approaching flood is given by the gulls which flock down to and pick up the food, as pigeons do wheat. Life on the beach, although plentiful enough, is nothing when compared with that of the open ocean, to realise which one must see the tow net after ten minutes run on a sunny afternoon.

Vegetable life is also richly developed on the surface of the ocean. Mr. Henry Tryon, in an interesting paper entitled "The Sea Scum and its Nature,"* describes how, at times, the sea is covered with a greenish-coloured film, which on investigation proved to be due to the presence of a minute alga or plant of the group Nostocaceæ. The Red Sea is said to owe its name to the occasional presence of such a scum produced by the allied form *Trichodesmium erythræum*.

Of pelagic fauna Professor A. Agassiz writes:—"One must have sailed through miles of Salpæ, with the associated crustacean, annelid, and mollusk larvæ, the acalephs, especially the oceanic siphonophores, the pteropods and heteropods, with the radiolarians, globigerinæ, and algæ, to form an idea of how rich a field still remains to be explored." Of this wealth of life as food the same author continues :—"A number of the marine animals ultimately depend for their food upon the pelagic fauna. The fishes feed upon the hosts of free swimming crustacea, many of which develop with immense rapidity ; these in their turn depend for their food upon smaller creatures floating in the water, and found everywhere in the track of currents. There can be no better evidence of the mass of food contained in the sea than is afforded by the examination of the contents of a tow-net any night. Pour the contents into a glass jar, and note the edge of the vessel exposed to the light,—it is covered with crustacea, annelids, and mollusks ; and examine also the residue at the bottom,—a true broth, consisting of the carcases of all the minute shore and pelagic animals, and a mass of spores of all sorts of marine plants. This broth is used in the Newport Laboratory to feed young fishes and other embryos kept in confinement."

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* Tyron—Proc. Roy. Soc. Qd., ii., 1885, p. 18.

To all interested in this subject, I would recommend a perusal of the delightful and readable work from which the foregoing are extracts.*

TEMPERATURES.

As part of the equipment I had thermometers for registering the temperature of the air, the surface of the water, and a deep-sea instrument for recording the bottom temperature. Observations were made whenever I could find time, but these I regret to say are of little or no value. After our final return to port it was discovered that the deep-sea instrument was damaged, but at what stage such occurred it is not possible to say.

THE SOUNDINGS.

In shallow water these were made with the ordinary hand-line, but the deeper ones were taken by means of a self-registering instrument. In the Preliminary Report certain differences appear in the depths as recorded by Mr. Farnell and myself. I should not consider it necessary to mention this here had not such discrepancy been noticed in print. Mr. J. D. Ogilby misquotes my figures† in giving the range of *Callanthias*, and remarks that such is doubtless a printer's error, in support of which he refers to Mr. Farnell's portion of the report. A reference to my table giving the particulars of stations, shows that the figures are consistent. This apparent discrepancy may be thus explained. The lead was heaved twice, thrice, or even four times, when the net was cast, and again when it was hauled, so that sometimes three or more readings were obtained, varying by a fathom or two. As Mr. Farnell's observations and my own were made quite independently, it sometimes happened that we did not record the same figures, as in the instance cited. In all cases I adopted the extreme readings.

While trawling the twelfth station on Feb. 22nd, and passing southward off Cape Three Points, one of the seamen drew my attention to what he described as a mass of seaweed floating just beneath the surface about thirty yards to seaward. On viewing the object with a glass, it was evidently not seaweed, and I believed it to be a collection of floating spawn. We were unfortunately towing the trawl at the time, and I had no means of obtaining any of the material. The sailor told me that he had previously seen such masses on the coast, and having once dipped up some in a bucket found it to be "a sort of jelly seaweed."

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* Agassiz—Three Cruises of the "Blake." Bull. Mus. Comp. Zool., xiv., 1888.

† Ogilby—Proc. Linn. Soc. N.S.W., xxiv., 1899, p. 172.

At times we encountered heavy weather, and on several occasions had to run for shelter. Once we were driven from our anchorage, and had to ride out the storm in the open seaway. Time was also lost by our encountering wreckage, river drift, or large boulders. On such occasions the net was usually more or less damaged, but in every instance the repairs were effected by those engaged on board.

Whenever rocks were encountered the fishes obtained were few in number, but on such occasions we reaped a rich harvest of Invertebrates, comprising Sponges, Gorgonias, Echinoderms, Crustaceans and Ascidians. We frequently obtained Feather-stars *(Comatula)*, while in eighty fathoms off Botany Bay, between two and three hundred examples of the rare Echinoderm, *Phormosoma hoplacantha*, Wy. Thompson, were hauled on board. This find was specially interesting, as the animal had previously been taken only by the "Challenger" at the minimum depth of 410 fathoms.

When first removed from the water, these Echinoderms presented a globular form and heaved with a panting or pulsating action. Water oozed from them until they became quite flat; if one of globular form was pricked with a knife the fluid ran out, the larger examples supplying quite a pint.

We placed a number of these Echinoderms in a large tin, stacking them to the height of about two feet; in a short time they had shrunk down to a layer of not more than six inches in depth, and were covered by the water which exuded from them. We found wounds from their spines to be very painful.

At first the trawl was also worked at night, apparently without any variation in the results, but as such gave double work and prevented sleep, night work was soon abandoned. On these occasions, however, a most beautiful spectacle was presented by the phosphorescent appearance of the fish as they darted hither and thither within the net, or lay on the deck a glowing mass. At night also it was only a moving streak of phosphorescent light that indicated the presence of a shark silently accompanying the vessel.

AREA TRAVERSED.

Although popularly styled a "deep-sea" venture, it is to be noted that this phrase is to be understood as of fishermen and not of naturalists. At no time was the 100-fathom line exceeded.

The following lines by W. H. Dall* bear on this subject: — "Formerly when dredging . . . . one hundred fathoms was considered extremely deep, and specimens from even half that depth were considered as having come from deep water. This was proper enough when the collections were compared with those from the shore between tides. . . . But when naturalists began to investigate at much greater depths, the old terms lost their meaning."

It was originally intended to work the whole of the coast line of the Colony, but in consequence of the time available being reduced and the desire to more thoroughly explore the immediate neighbourhood of the metropolis, this was not possible.

As will be seen by reference to the accompanying chart, the greatest number of hauls was made off Botany Bay and Port Hacking. Many trials were conducted off Broken Bay, at the mouth of the River Hawkesbury, while the well-known fishing grounds, the Newcastle and Shoalhaven Bights, also received considerable attention; more or less isolated attempts extended the area traversed from Jervis Bay to the Manning River.

The actual operations extended from February 19th to March 25th, and during this period the trawl was lowered sixty-one times. On two occasions, when the net was fouled, it was raised and at once dropped over the same spot, so that the number of stations is reckoned at fifty-nine.

The first thirty-three, together with the last haul, were made north of Port Jackson and extended to the Manning River, the depths tested being from 10 to 90 fathoms. Not usually working more than about eight miles from the shore, one essay was made at nineteen, and another twenty-six miles distant.

The remaining hauls as represented by Stations 34 to 58 took place between Port Jackson, southward to Jervis Bay, at depths varying between 10 and 80 fathoms.

A tabulated list of stations will be found on the following pages, and a chart at the end of the volume. Detailed accounts of each day's operations cannot be supplied until all the collections have been examined, when such may be fittingly published as a general summary to the work.

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* Dall—Bull. Mus. Comp. Zool., xii., 1885-6, p. 178.

Station.	Date.	Hour.	Locality.	Direction trawled.	Distance from shore in miles.	Depth in fathoms.	Nature of bottom.
	1898.						
1	19 Feb.	7·14 a.m. to 9·30 a.m.	Off Barranjoey Head.....	E.N.E.	$2\frac{1}{2}$ to $4\frac{1}{2}$	20 to 32	Gravel and sand.
2	19 ,,	11·20 a.m. to 1·20 p.m.	Off Cape Three Points.....	N.E. by E.	$4\frac{1}{2}$,, 6	32 ,, 40	Sand.
3	21 ,,	7 a.m. to 9 a.m.	Off Barranjoey.....	E.	6 ,, 9	31 ,, 55	Mud and shell.
4	21 ,,	9·30 a.m. to 11·30 a.m.	do	W. to S.E.	9 ,, $8\frac{1}{2}$	55 ,, 84	Sand, shell, mud.
5	21 ,,	12·45 p.m. to 2·30 p.m.	Off Narrabine.....	S.E.	$8\frac{1}{2}$,, $12\frac{1}{2}$	84 ,, 64	Soft mud.
6	21 ,,	3·10 p.m. to 6·30 p.m.	Off Long Point.....	S.E.	$12\frac{1}{2}$,, 19	67 ,, 80	Mud to sand.
7	21 ,,	7 p.m. to 10·40 p.m....	Off Port Jackson.....	W. to S.W.	19 ,, 9	80 ,, 62	Sand and gravel.
8	22 ,,	6·15 a.m. to 9 a.m.....	Off Barranjoey.....	N.	$4\frac{1}{4}$,, $1\frac{1}{2}$	25 ,, 28	do
9	22 ,,	9·45 a.m. to 12 noon....	Off Cape Three Points.....	S.E. to N.	$1\frac{1}{2}$,, 2	28 ,, 28	Brown sand.
10	22 ,,	1·30 p.m. to 5 p.m.....	Off Broken Head	N.E. by N.	2 ,, $4\frac{1}{2}$	28 ,, 28	Fine sand.
11	22 ,,	6·5 p.m. to 11 p.m.....	Off Tuggerah Lakes....	N.E. by N. to S.W. by S.	$4\frac{1}{2}$,, 6	28 ,, 34	Sand.
12	22 ,,	12·30 a.m. to 5·30 a.m.	Off Cape Three Points	S.S.W.	6 ,, 5	34 ,, 23	do
13	25 ,,	7 p.m. to 9 p.m.....	do do	N.E.	$5\frac{1}{2}$,, $7\frac{1}{2}$	41 ,, 50	Sticky mud and shell.
14	27 ,,	7·15 a.m. to 9·45 a.m...	Off Norah Head....	N.E. by N.	4 ,, 5	25 ,, 32	Sand and shell.
15	27 ,,	10·20 a.m. to 12 noon.	do	E.S.E.	5 ,, $8\frac{1}{2}$	32 ,, 48	Rocky.
16	27 ,,	3 p.m. to 6 p.m.	Off Bird Island.....	E.S.E.	$17\frac{1}{2}$,, 26	72 ,, 90	Fine sand and shell.
17	28 ,,	6 a.m. to 8·45 a.m.....	Off Broughton Island.....	S. by W.	3	29 ,, 48	Sand and shell to rock.
18	28 ,,	2·15 p.m. to 2·45 p.m.	N. off Port Stephens	S.S.W.	7 to 5	32 ,, 48	Rock.
19	1 Mar.	10·10 a.m. to 12·30 p.m.	S. of Port Stephens' Light..	S.S.W.	$1\frac{1}{2}$,, 4	32 ,, 52	Mud to stones.
20	1 ,,	1 p.m. to 2 p.m.....	Off Morna Point	S.W.	$1\frac{1}{2}$,, $3\frac{1}{2}$	23 ,, 30	Sand and pebbles.

PARTICULARS OF STATIONS—*(continued)*.

Station.	Date.	Hour.	Locality.	Direction trawled.	Distance from shore in miles.	Depth in fathoms.	Nature of bottom.
	1898.						
21	2 Mar.	8 a.m. to 10 a m.....	Newcastle Bight.....	S.W. by S.	4 to 6	28 to 40	Fine grey sand.
22	2 ,,	10·30 a.m. to 1·15 p.m.	do	W.S.W.	6 ,, 5	40 ,, 26	Grey sand to mud and shell
23	2 ,,	2 p.m. to 3·45 p.m.....	do	N.N.E.	$2\frac{1}{2}$,, 4	19 ,, 16	Mud and sand to pebbles.
24	4 ,,	7 a.m. to 9 a.m....	Off Newcastle	E.S.E.	5 ,, 8	21 ,, 48	Sand and mud.
25	4 ,,	9·30 a.m. to 10·15 a.m.	do	S.W. by W.	8 ,, $6\frac{1}{4}$	48 ,, 42	Soft mud.
26	4 ,,	1 p.m. to 3 p.m..... ...	do to Red Head.	W.S.W.	$4\frac{1}{2}$,, 3	32 ,, 20	Soft mud to fine sand.
27	5 ,,	7·30 a.m. to 9·35 a.m...	Off Manning River.....	S. by W.	2 ,, 4	22 ,, 23	Fine grey sand.
28	5 ,,	10 a.m. to 12 noon.....	do	S.E.	4 ,, $6\frac{1}{2}$	22 ,, 22	do
29	5 ,,	1 p.m. to 1·5 p.m..... 2 p.m. to 2·15 p.m....	In Manning Bight.....	S.W.	$4\frac{1}{4}$,, 3	18 ,, 17	Mud and rock.
30	6 ,,	8 a.m. to 8·10 a.m.....	Off Point Halliday	S.S.W.	7	35 ,, 35	Rock.
31	6 ,,	8·30 a.m. to 11 a.m.....	Off Cape Hawke	S.S.W.	$1\frac{1}{2}$	28 ,, 25	Sand, shell, and rock.
32	6 ,,	11·15 a.m. to 2 p.m.....	do	S. by W.	$\frac{3}{4}$ to $1\frac{1}{4}$	10 ,, 12	Sand to gravel.
33	7 ,,	8 a.m. to 10·15 a.m.....	Newcastle Bight (N. end)...	S. W.	$1\frac{3}{4}$,, $3\frac{1}{2}$	27 ,, 24	Sand and pebbles.
34	10 ,,	4·15 p.m. to 5·15 p.m..	Off Port Jackson..	S. by W.	$3\frac{1}{2}$,, $2\frac{1}{2}$	39 ,, 36	Sand and mud.
35	10 ,,	9·20 p.m. to 11·15 p.m.	Off Port Hacking..	S.E. to S.W.	$1\frac{1}{4}$,, 2	22 ,, 38	Sandy.
36	11 ,,	8·55 a.m. to 9 a.m.....	Off Botany Bay....	.....	1	23 ,, 20	Sand to rock.
37	11 ,,	5·30 p.m. to 7·30 p.m..	do	S.S.W.	2 to $2\frac{1}{2}$	50 ,, 52	Mud.
38	12 ,,	7 a.m. to 9 a.m.	Off Jibbon	S.S W.	3 ,, $2\frac{3}{4}$	46 ,, 55	Sand to mud.
39	12 ,,	9·30 a.m. to 12 noon....	Off Wata Mooli	S.S.W.	$2\frac{1}{4}$,, $2\frac{3}{4}$	50 ,, 50	Sand and shell.

PARTICULARS OF STATIONS—*(continued)*.

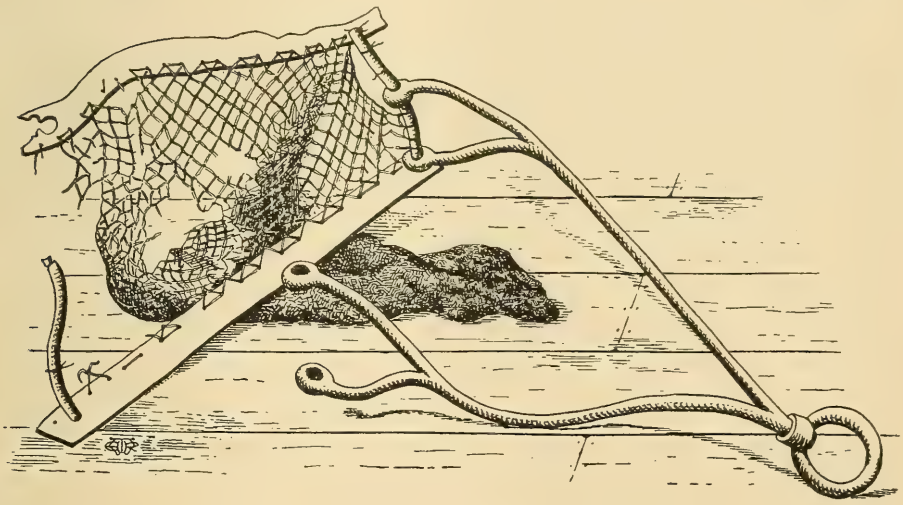
Station.	Date.	Hour.	Locality.	Direction trawled.	Distance from shore in miles.	Depth in fathoms.	Nature of bottom.
	1898.						
40	12 Mar	1·15 p.m. to 1·20 p.m. / 3 p.m. to 3·5 p.m.	Off Wata Mooli	S.	3	52	Sand and boulders.
41	13 ,,	7 a.m. to 9 a.m.	do	S.S.E.	2½ to 5¼	52 to 71	Soft mud.
42	13 ,,	9·30 a.m. to 12 noon.	do	S. by W.	6 ,, 8½	70 ,, 78	Coarse sand.
43	13 ,,	2 p.m. to 4·15 p.m.	Off Botany Bay	S.	1½ ,, 3½	43 ,, 66	Soft ooze.
44	15 ,,	4·20 p.m. to 5·10 p.m.	Off Coogee	S.S.E.	5 ,, 6	49 ,, 50	Fine sand.
45	16 ,,	6·50 a.m. to 8·50 a.m.	Off Botany Bay	S. by W.	2½ ,, 4½	55 ,, 66	Soft mud.
46	16 ,,	9·15 a.m. to 11·10 a.m.	Off Jibbon	N.	4½ ,, 3	66 ,, 50	Mud and Abattoir refuse.
47	16 ,,	3·50 p.m. to 5 p.m.	Off Bulgo	S. by E.	6 ,, 8½	63 ,, 57	do do
48	18 ,,	7·25 a.m. to 8·30 a.m.	Off Wollongong	S. by W.	7 ,, 8	55 ,, 56	Sand and mud to rock.
49	18 ,,	10·25 p.m. to 12·30 p.m.	Off Port Kembla	S.W. by S.	8 ,, 5	75 ,, 63	Mud and pebbles.
50	19 ,,	7·30 a.m. to 9·30 a.m.	In Shoalhaven Bight	S.S.W.	2	18 ,, 15	Sand.
51	19 ,,	9·45 a.m. to 11·45 a.m.	Off Shoalhaven River	.....	1½ to 2	15	do
52	19 ,,	12·45 p.m. to 2·15 p.m.	In Shoalhaven Bight	S. by E.	2½ ,, 3	19 to 20	Sand to mud.
53	19 ,,	3 p.m. to 3·5 p.m.	Off Crookhaven River	.....	4	23	Rock.
54	20 ,,	6·30 a.m. to 8·35 a.m.	Jervis Bay (within)	N.	.....	10 to 11	Seaweed and sand.
55	20 ,,	5·15 p.m. to 5·45 p.m.	Off Crookhaven River	N.E. to N.W.	1	15 ,, 11	Sand to rock.
56	22 ,,	7·50 a.m. to 10 a.m.	Off Botany Bay	S. by W.	8	79 ,, 80	Sand and stones.
57	22 ,,	11·30 p.m. to 1·50 p.m.	Off Wata Mooli	S.S.W.	3½ to 4	59 ,, 54	All mud.
58	22 ,,	3·10 p.m. to 5 p.m.	do	S.S.W.	1½ ,, 2	28 ,, 42	Fine sand to mud.
59	25 ,,	4·30 p.m. to 6·15 p.m.	Off Narrabine	N. to N.E.	4 ,, 5½	30 ,, 32	Coarse to fine grey sand.

On March 25th the "Thetis" left Sydney for Lord Howe Island, it being intended to test the trawling character of the ground around its shores. In consequence of the extremely rough weather this proved to be impossible. After a passage of seventy hours, as against the usual thirty-six, we were landed on the island, and there left for eleven days, the "Thetis" being blown to sea in the gale, returning to Sydney for coal and supplies before taking us off.

During the first few days on the island the weather was too boisterous and the sea too high to permit of any marine work. Afterwards we were enabled to get on to the reef, and also to draw the seine in the lagoon.

In conjunction with the Curator (Mr. Robert Etheridge, Junr.), who accompanied us on this occasion, I made collections of land animals, but as the "Thetis" had nearly all our collecting apparatus and preservatives on board we laboured under difficulties. Notwithstanding this we did some successful reef collecting, and were fortunate in securing additional remains of the extinct Chelonian, *Meiolania*.

It is possible that the Lord Howe Island collections may be examined and the results published as a supplement to the present work.



FISHES.

By EDGAR R. WAITE, F.L.S.,
Zoologist, Australian Museum.

FISHES.

By Edgar R. Waite, F.L.S.,

Zoologist, Australian Museum.

(Plates i.-xxx.)

The fauna of any place collected in 50 fathoms and under, will be best known by its fishes, as such are sought for economic purposes. The greatest results, as measured by the number of new species and rare forms, will obtain among the less-worked Invertebrata.

The least depth tested was 10 fathoms, and although the trawl once reached 90 fathoms (Station 16) it is to be noted that on this occasion fishes were not taken, due to an accident in shooting the net. The extreme productive depth was 84 fathoms, twice reached (Stations 4 and 5), but no species were there taken not known in shallower water. At three Stations, 6, 7 and 56, 80 fathoms was reached, but at the first named the net was again rendered almost inoperative, and at the other two no fishes peculiar to that depth were obtained. It is not necessary to carry the observations further, for it will be sufficiently apparent that no claim can be made to scientific deep sea trawling. It is further to be observed that the few new forms afterwards recorded were secured within the depths commonly attained by line fishermen: the number of new or rare species is therefore in excess of what was expected. It will be apparent, and this I suspect will be much more evident among the Invertebrata, that those forms previously known only from more southern or colder latitudes in shallow water are here taken in greater depths.

The following Stations were barren as far as fishes are concerned:—3, 14, 16, 19, 45; mainly due to the net becoming twisted, or otherwise getting out of order, while being lowered. At Stations 6, 18, 29, 30, 31, 36, very few fish were taken, the net or otter boards having fouled obstructions, such as rocks or wreckage.

One hundred and seven species were taken, representing ninety-five genera, including a new one, namely, *Paratrachichthys*, proposed for *Trachichthys trailli*.

Pterygotrigla is a new generic name substituted for *Hoplonotus*, which is preoccupied. Nine new species are described; these are :—

Dasyatis thetidis.
Chimæra ogilbyi.
Anthias pulchellus.
Monacanthus setosus.
Sebastes thetidis.
Lepidotrigla modesta.
Parapercis ocularis.
Histiopterus farnelli.
Paralichthys tenuirastrum.

The following nine known species are for the first time recorded for the Colony, and those marked with an asterisk have not before been recognised from Australia :—

**Narcine tasmaniensis*, Richardson.
Exocœtus evolans, Linnæus.
Macrorhamphosus scolopax, Linnæus.
Trachichthys elongatus, Günther.
**Paratrachichthys trailli*, Hutton.
Lagocephalus lunaris, Bloch.
Amblyrhynchotus oblongus, Bloch.
Chilomycterus jaculifera, Cuvier.
**Ichythyscopus inermis*, Cuvier and Valenciennes.

There are also a number of species not obtained since first recorded; among these may be mentioned :—

Creedia clathrisquamis, Ogilby.
Trachichthys elongatus, Günther.
Apogonops anomalus, Ogilby.
Epinephelus septemfasciatus, Thunberg.
Novaculichthys jacksoniensis, Ramsay.
Monacanthus mosaicus, Ramsay and Ogilby.
Centropercis nudivittis, Ogilby.
Synaptura fasciata, Macleay.

Several others collected, although perhaps not recorded, are known from additional specimens received at the Museum, and are therefore excluded from the above list.

All the new species have been figured, with the exception of *Dasyatis thetidis*, Ogil., of which adult examples are not available, and the type non-existent. My plan has been to illustrate all species obtained, not previously figured; this has been departed from only in a few instances and where the specimens obtained were immature or otherwise unsuited for delineation. On the other hand, some figures are published of species not obtained;

these are introduced for contrast with allied forms, and some species, whose illustrations were poor or in outline only, have been refigured.

The interest of the results is, however, not exhausted by an enumeration of the new or rare species; the expedition has been the means of materially extending the known range, both geographically and vertically, of several of our common food fishes. The breeding season of one or two species has been ascertained, and a little has also been learned of their habits. The following may be adduced as examples:—The Morwong (*Dactylosparus carponemus*) had been previously known only from adult specimens; we netted young individuals in from 50 to 75 fathoms, proving that the fish breeds with us, possibly in deep water. The Dory (*Zeus australis*), always a scarce fish in the market, and commanding a high price, was freely taken; it should, therefore, at some future date, take its place as one of our regular food fishes at a reasonable figure. Although our observations, both positive and negative, on the two common species of Whiting (*Sillago*) may need verifying, it would appear that, whereas the Sand Whiting (*S. ciliata*) is a shallow water form breeding on the sand banks of the bays and estuaries, the Trumpeter Whiting (*S. maculata*) is an inhabitat of greater depths, and sheds its ova in such position.

Of two somewhat similar Flounders, one (*Paralichthys novæ-cambriæ*) is shown to inhabit shallow water, frequenting the sand and mud banks close in shore and the estuaries of our rivers; the other (*P. tenuirastrum*) is confined to deeper water, and was previously overlooked.

Our knowledge of the habits of the Soles has also been extended, especially in the case of the Narrow-banded Sole (*Aseraggodes macleayana*). This splendid table fish was previously known only from that portion of the coast lying between Port Hacking and Lake Macquarie, and its breeding season was unknown. We took it nearly up to the limits of the operations, and discovered the breeding season to be March and April. The Black Sole (*Synaptura nigra*), hitherto known only from the estuaries, was taken off the coast.

Several obscure species have been redescribed, and specific characters of others have been emphasised, as in the case of *Monocentris*, represented by two species. These, one from Japan, and the other from our own coast, have been compared side by side.

The changes made in the nomenclature are simply such as appeared necessary when studying the relationship of the various species enumerated.

SELACHII.

Family HETERODONTIDÆ.

HETERODONTUS, *Blainville.*

HETERODONTUS PHILLIPI, *Lacépède.*

PORT JACKSON SHARK.

(Plate i.—*Gyropleurodus galeatus*, Günth.)

Le Squale Philipp, Lacép., Hist. Nat. Poiss., i., 1798, p. 218.
Heterodontus phillipi, McCoy, Prod. Zool. Vict., Dec. xii, 1886, pl. cxiii.

Stations 10, 15, 20, 21, 22, 23, 24, 25, 26, 32, 34, 50, 51, 52.

We did not obtain this species in water deeper than 48 fathoms; it is not included in the captures of the Challenger Expedition off Twofold Bay (Station 163A, 120-150 fathoms), and no observations on its vertical range have been made. We took it in 10 fathoms, while it is very common in 6 or 7 fathoms within the harbour of Port Jackson.

Geographically it extends to Southern Australia, being common in Hobson's Bay. It occurs also in Tasmania and is recorded from New Zealand, where, however, it must be extremely rare. Apparently its inclusion rests on the evidence of two specimens presented to the British Museum by Professor Owen and said to have been obtained in New Zealand. Hutton includes it in his Catalogue* on this authority, but writes:—"I have seen no specimens." It is mentioned by Saville Kent,† as being occasionally taken in Moreton Bay, Queensland, but it does not seem to have been recorded on our own coast northward of Broken Bay. We took it off Cape Hawke (Station 32), thence southward to Shoalhaven Bight (Stations 50, 51 and 52). It had been previously obtained in Jervis Bay, and from my own experience I should say it is as common there as on any part of the coast. Jervis Bay is a favourite breeding resort, and the empty egg-cases may be found in large numbers washed on to the beach or wedged in among the rocks: here also in 20 fathoms and under, living eggs may be freely obtained. Not being the proper season, we secured only empty cases; these were twice obtained, namely, in Jervis Bay (Station 54) and in Newcastle Bight (Station 22).

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* Hutton—Fishes of New Zealand, 1872, p. 80.

† Saville Kent—Oyster and Oyster Fisheries, Queensland, 1891, p. 11.

I have previously described the egg-case of this species* and also that of *Gyropleurodus galeatus*, Günther, and although all the Port Jackson Sharks netted were critically eyed, neither the crested species nor its egg-case were taken.

When ashore at Wollongong and Kiama I noticed egg-cases exhibited as curiosities in the shop windows; all so shown were of *G. galeatus*. The known range of this latter species may be thus extended southward; it had been previously obtained as far north as Port Stephens.

Ogilby recently† described a pair of Cestrationt jaws taken some years previously off Manly Beach, to the north of Port Jackson, and while admitting a general likeness to those of *G. galeatus*, inclined to the belief that they might prove to belong to an unknown species. With a view to elucidating this matter, Mr. Ogilby and myself compared the jaws with those of *G. galeatus* preserved in the Museum. They proved to be in every way identical. Günther has not mentioned the teeth in his description of this species, and Macleay's figure does not represent them. I supplement Ogilby's description above referred to, by a figure of the jaws kindly lent for the purpose; but the question remains, to what species did the jaws figured by Macleay belong?

Family SCYLLIORHINIDÆ.

CATULUS, *A. Smith.*

CATULUS ANALIS, *Ogilby.*

SPOTTED CAT-SHARK.

(Plate ii., fig. 1.)

Scyllium anale, Ogilby, Proc. Linn. Soc. N.S.W., x., 1885, pp. 445, 464.

Stations 2, 10, 12, 13.

Ogilby remarks that this species seems to be common in the neighbourhood of Port Jackson, within the harbour of which the type was obtained. We did not find it to be very common outside, the four stations not yielding more than a dozen individuals. All were obtained within the very limited portion of the coast lying between Broken Bay and Tuggerah Lakes. This species was taken in depths ranging from 23 to 50 fathoms; the largest example measured 570 mm. or 22½ inches, just the length of the

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* Waite—Journ. Linn. Soc., xxv., 1896, p. 325, pl. xii.

† Ogilby—Proc. Linn. Soc. N.S.W., xxii., 1897, p. 245.

type specimen. The markings are not quite so regularly arranged as in the specimen originally described. The example figured is a female.

PARASCYLLIUM, *Gill.*

PARASCYLLIUM COLLARE, *Ramsay & Ogilby.*

COLLARED CAT-SHARK.

(Plate ii., fig. 2.)

Parascyllium collare, Rams. & Ogil., Proc. Linn. Soc. N.S.W., (2) iii., 1889, p. 1310.

Stations 1, 8, 10, 11, 13.

In the original description the colour is stated to be rich brown with six broad darker transverse bands, the lower parts dull white. The general colour would be better expressed as yellowish, tinged with brown, and there are eight bands, two of which are situated on the tail. The under parts are yellow.

At each of the five Stations above named this handsome species was freely taken. It was previously recorded only from outside Port Jackson in 70 fathoms, but has also been taken off Port Hacking. We never took it in depths greater than 50 fathoms, the shallowest Station showing 20 fathoms. It would appear to be very locally distributed, as with Dog-fishes in general, for it was obtained only off the coast between Broken Bay and Tuggerah Lakes, to the north of Port Jackson. Our largest example measures 825 mm. or $33\frac{1}{4}$ inches, which is perhaps the maximum of growth. This specimen, a male, is figured.

Family ORECTOLOBIDÆ.

ORECTOLOBUS, *Bonaparte.*

ORECTOLOBUS BARBATUS, *Gmelin.*

WOBBEGONG.

Squalus barbatus, Gmel., Syst. Nat., i., 1788, p. 1493.
Crossorhinus barbatus, McCoy, Prod. Zool. Vict., Dec. v., 1880, pl. xliii., fig. 1.

Station 24.

Obtained so freely by means of the trawl in Port Jackson, and occurring throughout the whole coast line of the Colony, it is a

little remarkable that we secured but a single example. This, a small specimen, was taken off Newcastle in 21-48 fathoms.

Family GALEIDÆ.

GALEUS, *Rafinesque.*

GALEUS ANTARCTICUS, *Günther.*

GUMMY.

Mustelus antarcticus, Günth., Cat. Fish. Brit. Mus., viii., 1870, p. 387. McCoy, Prod. Zool. Vict., Dec. ix., 1884, pl. lxxxvii., fig. 1.

Stations 11, 12, 21, 37, 48, 49, 52.

Günther's original specimen, having doubtless become discoloured, was described as "uniform greyish." McCoy correctly described the colour as follows:—"Back and sides ashy-grey with a slight pinkish-brown tinge on side of head and body: with, from nape to second dorsal, very small lighter spots on back and sides above lateral line"; he further says:—"Whole under surface of body and under side of pectorals and ventrals milk-white." This refers, however, only to the basal portion and the margins, the larger portion of these fins being coloured alike above and below. In our examples the hind edge of the dorsal and the tip of the caudal are not darker than the other portions. While the small milk-white spots are present in most of our specimens, no trace of such exist in others. On the side next the body the claspers *(Pterygopodia)* are of grey colour, but below are whitish like the whole ventral surface of the shark. The growth of the claspers is well illustrated in our series and may be thus briefly noticed.

In fœtal stages the claspers do not reach to the margin of the ventral fin, but attain to that point shortly after birth. They do not, as a rule, appear to be developed further until much older, and in an example measuring 585 mm. (23 inches) they have barely outgrown the fin. On the other hand, a smaller specimen measuring 530 mm. (20¾ inches) has them nearly twice as long as the inner posterior margin of the fin. No specimen of such dimensions has any rigid skeletal development in the claspers. The smallest example in which such appears is 625 mm. (24¾ inches) in length.

Parker has described* how, in this species, the embryo is attached to the uterus with a placenta: it is therefore referable to

* Parker—Trans. N.Z. Inst., xv., 1883, p. 219, pl. xxx.

the genus *Galeus*, where now placed. If future research should suggest the necessity of uniting the genera *Mustelus*, Cuvier, and *Galeus*, Rafinesque, the latter, being the older name, would still have priority.

GALEORHINUS, *Blainville.*

GALEORHINUS AUSTRALIS, *Macleay.*

School Shark.

Galeus australis, Macl., Proc. Linn. Soc. N.S.W., vi., 1881, p. 354.
McCoy, Prod. Zool. Vict., Dec. vii., 1882, pl. lxiv., fig. 2.

Stations 20, 21.

An example of this species measuring three and a half feet in length was taken in the trawl in 23-30 fathoms, off Morna Point, to the south of Port Stephens, the most northerly recorded habitat. A second specimen, but thirteen inches in length, was obtained a little further south in the Newcastle Bight at a depth of 28-40 fathoms.

Family SPHYRNIDÆ.

SPHYRNA, *Rafinesque.*

SPHYRNA LEWINI, *Lord.*

Hammer-headed Shark.

Zygæna lewini, Lord in Griffith, Ann. King., x., 1834, p. 640, pl. L.
Zygæna malleus, McCoy, Prod. Zool. Vict., Dec. vi., 1881, pl. lvi., fig. 1.

Station 51.

In 15 fathoms off Shoalhaven Bight we netted a large number of these sharks. They were, however, all of small size, ranging from one to four feet in length. Curiously enough, this was the only occasion on which they entered the trawl.

The Hammer-headed Shark was the species most frequently seen, and when "Shark, oh," was called, it was generally to observe one of these brutes swimming alongside the "Thetis." The largest example noticed (off Seal Rocks) was computed to be about twelve feet in length. On one occasion one of the sailors, having strung some skate, hung them over the stern in order to wash off

some sepia from the cuttle-fish. Small thought was given to the shark cruising alongside, until it was discovered that the skate had been eaten off and the shark was anxious for more. At night, also, sharks kept pace with us, as indicated by the phosphorescent glow which accompanied their movements.

This species is here accorded specific rank on account of the following peculiarity. Writers on *S. zygæna* (= *Zygæna malleus*) describe that species as having the nasal groove running along nearly the whole front margin of the head. In our specimens, as above described, the groove is much less extensive. I at first thought that this condition might be characteristic of immaturity, but a comparison with two examples in the Museum, one of which measures fifteen and a half feet in length, shows that in these the nasal groove is also comparatively short, relatively shorter than in the young.

The "Zoological Record," 1882, supplies the following reference, "*Zygæna leewini*, Griff., is distinct from *Z. malleus*, Rochebrune, Act. Soc. L. Bord., vi., p. 56." I have not access to this paper, but Rochebrune's conclusions have not been accepted by Jordan & Evermann, who in their latest work* continue to place *Z. lewini* as a synonym of *S. malleus*. The following is a description of our examples :—

Head hammer-shaped, rather more than three times as wide as its length at the eye; the anterior margin is rounded, the space between the nostrils, which are situated near the eyes, formed of three lobes, one median and two lateral, the former the larger; a pronounced groove passes from the nostril along the anterior margin of each lateral lobe and is deflected slightly inwards at its junction with the median lobe. Each groove is less than one-third the width of the head measured between the preocular prominences. As in *S. tudes*, the grooves are preceded by a line of pores. On the under side of the head several patches also occur, the most noticeable of which occupies a triangular depression in the centre of its anterior margin; another series arises from the juncture of the lateral and median lobes and passes obliquely inwards and backwards towards a position in front of the mouth; this is succeeded by a less marked line continued inwards to meet the base of the last named series. A row of more widely spaced pores passes outwards towards the orbit, which has an irregular patch at the posterior border. Finally a series of pores is found on the free skinny portion at the hinder part of the head on each side. At its external angle this membrane is produced backwards.

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* Fishes of North America. U.S. Nat. Mus., Bull. 47, 1896, p. 45.

Teeth in two alternate rows in each jaw, placed obliquely, notched externally, otherwise entire. The fifth gill opening is smaller than the others, all are equally spaced, and the last two are situated above the base of the pectoral. The space between the origin of the first dorsal and the front of the head is slightly more than the width of the latter; this fin arises wholly behind the pectoral, its base is contained two-thirds in its height, which equals half the width of the head, it is posteriorly produced. The second dorsal, situated over the posterior third of the anal, is small and produced backwards into a long acuminate lobe. The ventral arises midway between the origin of the pectoral and the base of the caudal. The anal is larger than the posterior dorsal, deeply excavated behind and produced like that fin. The caudal is contained three and a half times in the total length, the lower lobe two and a half times in the upper; the notch is small.

Colour.—The general colour above, the under part of the membrane behind the head, and the membraneous portions of all the fins is of a dull lead colour. All other portions of the under surface are yellowish-white.

Family CARCHARIIDÆ.

CARCHARIAS, *Rafinesque.*

CARCHARIAS TAURUS, *Rafinesque.*

GREY NURSE.

Carcharias taurus, Rafin., Caratt. d' Alc. Nuov. Gen., 1810, p. 10, pl. xiv., fig. 1.

Odontaspis taurus, McCoy, Prod. Zool. Vict., Dec. vii., 1882, pl. lxiv., fig. 1.

Station 23.

On raising the trawl off Newcastle, from the depth of 16 to 19 fathoms, some little excitement was caused on discovering that we had a shark in the net; on being hauled aboard it swept the fish right and left until despatched. It was of this species and measured eight feet in length. A somewhat larger example was hooked in Broken Bay. Sharks were specially attracted to the "Thetis" on account of the amount of food thrown over, comprising mainly the inedible species, such as sting-rays, fiddlers, dogfishes, etc., together with the waste parts of the fishes preserved for consumption. There has been no previous authentic record of the Grey Nurse having been taken north of Port Jackson.

Family PRISTIOPHORIDÆ.

PRISTIOPHORUS, *Müller & Henle.*

PRISTIOPHORUS CIRRATUS, *Latham.*

SAW SHARK.

Pristis cirratus, Lath., Trans. Linn. Soc., ii., 1794, p. 281, pls. xxvi. (fig. 5), and xxvii.

Stations 1, 4, 10, 13, 15, 20, 21, 24, 25, 26, 34, 37, 38, 40, 46, 57, 58.

Extremely common all along the coast, this species was taken from the minimum and maximum depths of 20 and 84 fathoms, both records being off Broken Bay, the former two and a half and the latter nine miles from shore.

It proved a source of considerable trouble to the trawlers by becoming entangled in the meshes of the net. The sharp teeth not only rendered extrication difficult, but necessitated cautious handling. In this respect little examples, not exceeding a foot in length, were equally annoying with the adults. The largest specimen taken measured 1272 mm. (=50 inches), which is probably the maximum of growth. The most northern Station (20) whence the species was obtained was off Morna Point, south of Port Stephens. Southward it was not taken beyond Port Hacking. According to McCoy* and Castelnau,† *Pristiophorus nudipinnis*, Günth., is the common Saw Fish of Hobson's Bay, while the latter remarks that he had not seen *P. cirratus* from Victoria, although it is known from Tasmania.

Family SQUATINIDÆ.

SQUATINA, *Duméril.*

SQUATINA SQUATINA, *Linnæus.*

ANGEL FISH.

Squalus squatina, Linn., Syst. Nat., Ed. x., 1758, p. 233.
Rhina squatina, McCoy, Prod. Zool. Vict., Dec. iv., 1879, pl. xxxiv.

Stations 5, 7, 24, 32, 34, 35, 43, 46, 48, 50, 52, 54, 57.

This widely distributed species was taken freely all along the coast line visited with the exception of the small portion between

* McCoy—Prod. Zool. Vict., Dec. vi., 1881, pl. lvi., fig. 2.

† Castelnau—Proc. Zool. Soc. Vict., i., 1872, p. 220.

Cape Hawke and Crowdy Head. The former is the most northern point at which the species has been taken on our coast. For the most part the specimens were small, but a few really large examples were netted, chiefly females; nearly all these gave birth to many living young while on deck. While some of the young ones were of uniform tint, either grey or brown, others were mottled and spotted in a very pretty manner, the markings being brighter and more defined than in any of the adults.

Family RHINOBATIDÆ.

RHINOBATUS, *Bloch & Schneider.*

RHINOBATUS BANKSII, *Müller & Henle.*

SHOVEL-NOSED RAY.

(Plate iii.)

Rhinobatus banksii, Müll. & Henle, Plagiost., 1838, pp. 123 and 192.

Stations 1, 10, 11, 22, 24, 25, 26, 32, 51, 59.

In his "Notes on the distribution of some Australian Sharks and Rays," Ogilby* identified our common Shovel-nosed Ray with *Rhinobatus bougainvillii*, remarking:—"This is the common *Rhinobatus* of the New South Wales coast, and is found at least as far north as Cape York." He has since mentioned to me that our species more nearly agrees with the description of *R. banksii*, Müll. & Henle, an opinion in which I concur. The authors of this species state that the description is from a drawing (zeichnung) by Banks in the British Museum, while they give its synonymy as "*Raja rostrata*, Banks, M.S. 45." It is scarcely clear therefore whether the description supplied is from Banks' M.S. or a drawing only. The habitat of *R. bougainvillii* is unknown, while that of *R. banksii* is rendered as New Holland.

In order to better establish the species, I have supplied both a description and figure from examples collected. We took it off Cape Hawke (Station 32), thence southward to Shoalhaven Bight (Station 51) and vertically from 10 to 48 fathoms.

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* Ogilby—Proc. Linn. Soc. N.S.W., x., 1886, p. 464.

Disc long and narrow, the snout much produced and acute, its length 2·3 in that of the disc, interorbital width 5·8 in the length of the snout. Rostral ridges convergent, meeting at less than half the distance to the tip of the process and traceable as a shallow groove on the upper surface. Nostrils large, the distance between their outer angles less than half the snout, the distance between their inner angles a little greater than the width of each nostril. The anterior valve is produced as a fold slightly towards the median line. Mouth bow-shaped, its width twice that of the interorbital space, which is slightly concave, no fimbriate appendage on the snout of the female. Vent equally distant from the tip of the snout and the base of the caudal, or a trifle nearer the latter. Dorsal fins similar. Skin finely shagreened. Two very small spines near the tip of the snout, two conical spines in front and two behind each eye. Twenty-one low spines on the dorsal line to the first fin and three or four between the fins, two pairs on the shoulder girdle on each side of the dorsal line and five rows of minute dermal elevations at each outer angle of the disc.

Colour.—Olive-yellow above, the fins grey with yellowish margins. Bluish-grey to yellowish beneath, a dark patch towards the tip of the snout extending backwards along the rostral process. Length of specimen described, 555 mm.; width nearly three times in the total length; tail rather more than twice; snout to the mouth 4·6 times in the same.

TRYGONORHINA, *Müller & Henle.*

TRYGONORHINA FASCIATA, *Müller & Henle.*

FIDDLER.

Trygonorhina fasciata, Müll. & Henle, Plagiost., 1838, p. 124, pl. xliii.

Stations 1, 2, 21, 22, 23, 24, 25, 27, 28, 50, 54, 55, 57, 59.

Although very common in Port Jackson, thence southward to Tasmania and South Australia, it does not appear that observations have been recorded as to the northern range of the species, a remark applicable also to many other forms. We took it at the northern limit of our operations, namely, in the Manning Bight, south of Crowdy Head (Station 27). Vertically it is found from a few fathoms in the harbour to at least 59 fathoms, at which depth we obtained it.

Family RAJIDÆ.

RAJA (*Artedi*), *Linnæus.*

RAJA AUSTRALIS, *Macleay.*

SKATE.

(Plate iv.)

Raja australis, Macl., Proc. Linn. Soc. N.S.W., viii., 1884, p. 461.

Stations 4, 5, 7, 10, 11, 12, 13, 17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 31, 32, 34, 35, 37, 38, 39, 42, 43, 46, 48, 49, 53, 56, 57, 58.

First recorded from examples taken off Botany Bay in 40-55 fathoms, the known distribution of the species does not seem to have been since extended. It was freely obtained by the "Thetis" along the whole of the coast line traversed, and it doubtless occurs to the limits of the colony, and beyond, more especially as it proves to inhabit deep water. It has a considerable vertical range, having been secured at all depths between 10 and 84 fathoms. The largest example previously recorded measured 15 inches in length; some of ours attain to 19 inches (485 mm.).

The following notes are in elaboration of Macleay's description: Disc broader than long; the setous spines above the snout are directed forward, those below backward. The mouth is described as being straight; this is not correct, it being of the usual bow-shape. In the male the median teeth of both jaws are acutely spinous, the lateral ones acute only. In the female the teeth are nowhere spiny. The disc of the male is much more spiny than in the female; its anterior margin has a series of fine spines which extend neither to the snout nor the angle; between this series and the eye is a patch of twelve strong recurved spines, and further back and nearer to the margin is another similar patch. At the angle, but some distance from its margin, are twenty-four slender spines arranged anteriorly in two rows directed obliquely inwards and backwards. The tail is armed with a median row of strong spines, the alternate ones towards the hinder portion becoming almost obsolete; a single spine is placed between the fins. Six similar spines are placed on each side of this series, the first pair being situated behind the third spine and the last an equal distance in advance of the terminal one. Posteriorly the sides of the tail are covered with minute spines; a few occur also on the fins. The spines around the eye form a semicircular series embracing the anterior and inner border, the central spine being minute. A short spine occupies a median position between the

posterior margin of the eyes and the shoulder girdle. On the under side, the spinous rostral portion extends to the nostrils and is continued for some distance along the margin of the disc, and as a band on each side to the level of the mouth.

In the female the two large patches of spines between the eye and the margin of the disc, and also those at the angle, are absent; on the under side the spines extend for some distance along the margin, but are not continued towards the nostrils. There are five rows of spines on the tail instead of three only, as in the male; of these the outer row is the shortest and is composed of nine or ten pairs. The sides and the fins are spiniferous as in the male and similarly a spine exists between the fins.

Colour.—Above, the colour is uniform olive-brown, lighter on the snout and at the margin of the disc; beneath it is lighter, with scattered brown spots and with yellow marks at the bases of the discs and on the ventral fins. The numerous pores on the under side of the snout and head are also black.

Family NARCOBATIDÆ.

NARCINE, *Henle.*

NARCINE TASMANIENSIS, *Richardson.*

TASMANIAN NUMBFISH.

Narcine tasmaniensis, Rich., Proc. Zool. Soc., 1840, p. 29, and Trans. Zool. Soc., iii., 1849, p. 178, pl. xi., fig. 2.

Station 42.

All the specimens seen by Richardson were females. Our single example is a male. This does not appear to differ from the description excepting in the sexual characters and the nature of the teeth. While agreeing in their general character and disposition, the teeth of the male are spiniferous, a very common sexual distinction in the Rays; the dental lamellæ are very flexible, and the mouth is small and protractile. The fleshy portion of the tail is broader towards its extremity than in Richardson's figure (2*a*), or in other words, its tapering is much more obtuse. The claspers are blunt and short, not longer than the distance of the eye from the anterior margin of the disc. The colour above is a warm brown, much redder than in the figure quoted; the sides of the tail and the inferior anterior margin of the disc are yellowish, the under side, including the claspers, above and below, white. Length of specimen, 343 mm. (13½ inches).

Richardson remarks that he is not aware if the electrical powers of this fish has attracted the attention of the colonists. I was able to practically demonstrate that its electrical properties are quite manifest to the human system, but in so small a species (or at least of the size of our example) the shock is not unpleasantly strong. It is to be borne in mind, however, that in consequence of the handling to which it had been subjected in the trawl, it may have largely exhausted the batteries in electrifying its fellow captives.

This interesting addition to our fauna was taken off Wata Mooli (south of Port Hacking), in 70-78 fathoms. Not previously known outside the waters of Tasmania, this is an admirable example of how southern forms seek the deeper waters of milder zones. Although the immediate area around Port Hacking has been systematically fished for years, the *Narcine* has probably never before been taken, doubtless owing to the fact that operations are always conducted in water shallower than suits it in these warmer latitudes. Another signal instance is that of the large mollusc *Voluta mamilla*, taken in the waters of New South Wales by the "Thetis," and hitherto regarded as a characteristically Tasmanian species.

HYPNOS, *Duméril.*

HYPNOS SUBNIGRUM, *Duméril.*

NUMBFISH.

Hypnos subnigrum, Duméril, Rev. Zool., 1852, p. 279, pl. xii.

Stations 21, 24, 25, 52, 55.

Duméril describes this species as being of intense blackish-brown colour. Such would apply to all small examples, but the adults taken were of much lighter tint, being rich yellowish-brown.

It was provocative of considerable amusement whenever it appeared on board; the uninitiated, however, shortly learned to recognise it and respect its peculiar qualities, so that soon no one could be persuaded to touch it even with an iron prodder.

At Station 55 I unwittingly placed my hand on one as it lay on deck partly concealed by overlying fishes. As was afterwards found, it was the largest example obtained, and measured 690 mm. (2 feet 3 inches) in length. The shock I so unexpectedly received was very intense, and it is quite conceivable that the one from such a fish, not previously harassed, would be sufficient to disable a man. When compared with *Narcine*, the mouth of *Hypnos* is very large, and a medium sized

example of *Beryx affinis* was removed from the gullet of the specimen referred to.

The Numbfish was taken only in two situations, namely, off Newcastle (Stations 21, 24 and 25) and in Shoalhaven Bight (Stations 52 and 55), the depths ranging from 11 to 18 fathoms.

Family DASYATIDÆ.

In my note on *Lepidotrigla* I refer to the impossibility of personally examining every individual of the genus obtained, and the same remark is applicable equally to the members of the family *Dasyatidæ*.

There is no difficulty as to the genus *Dasyatis*, the few specimens received are correctly chronicled; the difficulty is mainly with the two species *Urolophus cruciatus* and *Trygonoptera testacea*. Although these are referred to different genera, the only observation one could make "in the field" was as to the absence or presence of a dorsal fin, and that a very small one. Although no fin is present in *Urolophus* a small scar is observable in *U. cruciatus* in advance of the spine just where the fin would be situated if present. In young examples, at least in the fœtal stage, a small fin is distinctly present; it is therefore questionable if the genera are worthy of separate recognition.

Urolophus cruciatus is found in the deeper water all along the whole coast line, while *Trygonoptera testacea* is more common in the estuaries.

The following is a complete list of the Stations at which the two species were taken; individual localities are recorded under the respective species:—

Stations 1, 4, 7, 8, 9, 10, 11, 12, 13, 17, 20, 21, 24, 25, 26, 27, 28, 32, 33, 34, 35, 37, 38, 39, 42, 43, 47, 48, 49, 50, 51, 52, 54, 55, 57, 58, 59.

UROLOPHUS, *Müller & Henle.*

UROLOPHUS CRUCIATUS, *Lacépède.*

BANDED STINGAREE.

Raja cruciatus, Lacép, Ann. Mus., iv., 1804, pp. 201, 210, pl. lv., fig. 2.

Urolophus cruciatus, Rich., Zool. Ereb. & Terr., Ichth., 1844, p. 35, pl. xxiv.

Stations 4, 7, 8, 10, 11, 12, 13, 17, 20, 21, 24, 25, 26, 27, 28, 34, 35, 37, 38, 39, 42, 43, 47, 48, 49, 57, 58 59.

This was one of the most unwelcome species met with, in consequence of its ubiquity and profusion. Although of small size

the barbed spine in its tail suggests cautious handling. The odium in which it was held on board could be well gauged by observing the viciousness with which the men employed impaled it with the iron prodders provided before whirling it over the bulwarks.

It was taken along nearly the whole area traversed where the trawl reached a depth of 20 fathoms or more. In shallower water it was not obtained, and was consequently not represented in our gatherings from Shoalhaven Bight and Jervis Bay. It was netted freely in 84 fathoms, but was not secured at Station 16, twenty-six miles from land, where the depth of 90 fathoms was attained. As previously mentioned, however, no fishes were there taken, due to an accident to the gear.

Fœtal specimens possess a small dorsal fin in advance of the spine; this is not present in the adult and its position is indicated only by a small scar.

TRYGONOPTERA, *Müller & Henle.*

TRYGONOPTERA TESTACEA, *Müller & Henle.*

Common Stingaree.

Trygonoptera testacea, Müll. & Henle, Plagiost., 1838, p. 174, pl. lvii.

Stations 1, 8, 9, 26, 32, 33, 50, 51, 52, 54, 55.

Unlike the preceding, this species was taken only in comparatively shallow water, never exceeding 32 fathoms, and more plentiful shoreward, being common on the 10-fathom line, within which we did not venture. This is the form so freely taken within the harbour and along the shore line.

TRYGONOPTERA BUCCULENTA, *Macleay.*

Great Stingaree.

(Plate v. and fig. 3.)

Urolophus bucculentus, Macl., Proc. Linn. Soc. N.S.W., ix., 1885, p. 172.

Stations 11, 24, 25.

Only thrice recognised; the observations made upon this species are necessarily scanty, more especially as the specimens

are absent from the collection, having, it is supposed, been inadvertently returned to the water by some of the seamen. Medium sized examples: they were obtained at the extremes of 21 and 48 fathoms. Hitherto we had known only large specimens; it would, therefore, appear that this is a deep water form, only the largest individuals trending shoreward. The type specimens were taken in 40 to 60 fathoms outside Port Jackson; as this was previously the only known habitat we are able to extend its range slightly to the northward; Stations 24 and 25 being off Newcastle, while Station 11 is intermediate between that area and Port Jackson.

The following description and figure, together with the plate, are taken from the type specimen. As this is a skin only, the productions are not wholly satisfactory.

Disc angular, its breadth equals its length to the extremity of the ventrals, the anterior margins rather straight, forming an obtuse angle. Snout to the middle of the eyes three times the width of the interorbital space. Spiracle rather larger than the eye, width of jaws half the length of the snout in front of them. Caudal shorter than the disc, its spine very large, equal to the length of the snout below, the edges closely beset with retrose spinules, the extreme tip and basal portion excepted, its insertion nearer the extremity of the tail than the axis of the pectoral. Dorsal fin comparatively large. Caudal membrane deep. Teeth obtuse, in about 18 rows in the upper jaw. Skin quite smooth. Colour above, and the margins of the disc below, uniform dark brown, other parts yellow.

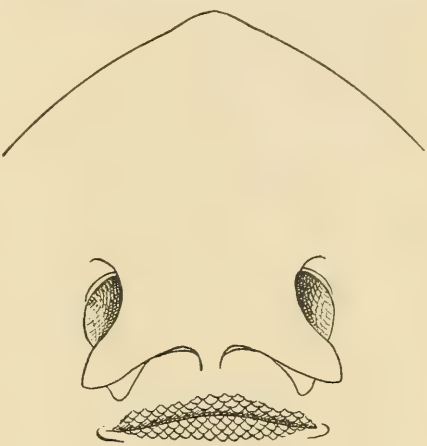

Fig. 3.

Macleay has pointed out the main distinction between this species and *T. testaceus,* and the accompanying figure (fig. 3) shows the great comparative size of the dental lamellæ; other features are the broader and more angular disc, shorter tail, larger dorsal and rounder and broader caudal.

DASYATIS, *Rafinesque.*

DASYATIS THETIDIS, sp.nov.

Black Sting Ray.

Dasyatis thetidis, Ogilby, MS.

Stations 21, 22, 23, 58.

"Disc subquadrangular rather more than one-fourth wider than long. Anterior border sinuous, convex near the slightly protuberant snout and the rounded angle, concave between; posterior and inner borders conspicuously convex, the hinder angle obtuse. Skin smooth, a row of strong, rounded or oval, stellate tubercles along the median line of the back and tail, each tubercle armed with a stout depressed spine directed backwards; scapular region with one or two similar tubercles. Mouth rather feebly crescentic, its width two-fifths of the preoral length and four-fifths of the distance between the anterior angles of the nostrils; buccal papillæ five, the outer pair small and remote from the inner three.

"Teeth arranged quincuncially, in 16 series in the upper and 21 in the lower jaw, the crown of each tooth hollowed mesially. Hinder border of ventral fins feebly convex, the angles rounded. Tail depressed before, cylindrical behind the spine, rounded and keelless above, a low cutaneous expansion below, armed on all sides with stout spines.

"Dark olivaceous-brown, teeth flesh-coloured, with a median transverse orange band.

"This is the common 'Black Sting-Ray' of Sydney, and is probably the species spoken of by Dr. Günther and his followers as *Trygon tuberculata.* The length of the disc in the specimen described was 1,000, its width 1,275 millimeters; the tail was broken off some distance behind the spine."

The specimen above described was one of three, taken in consecutive hauls in Newcastle Bight, the depths ranging from 16 to 40 fathoms. These rays weighed respectively 160lb., 220lb., and 140lb. A fourth example weighing 180lb. was taken south of Port Hacking in 28-42 fathoms. The ray above described was forwarded by me to the Museum, but having been much damaged in transit was not preserved. Mr. J. D. Ogilby, who happened to be in the institution at the time it was received, made the foregoing description at the request of the Curator, and has since handed it to me for publication.

A young *Dasyatis*, obtained likewise at Station 22 and preserved, agrees in all essential points with the description. In

common with most juveniles of the genus it is quite smooth ; the tail measures more than twice the length of the disc. Dark olive-brown above, the under surface and the lower base of the tail is whitish, the margins of the disc brown. The absence of a membraneous expansion above the tail places the species in the subgenus *Hemitrygon*, Müll. and Henle.

Family MYLIOBATIDÆ.

MYLIOBATIS, *Duméril.*

MYLIOBATIS AUSTRALIS, *Macleay.*

EAGLE RAY.

Myliobatis australis, Macl., Proc. Linn. Soc. N.S.W., vi., 1881, p. 380. McCoy, Prod. Zool. Vict., Dec. vii., 1882, pl. lxiii.

Stations 1, 10, 20, 21, 22, 23, 24, 25, 26, 50, 51, 52, 53, 54, 58.

McCoy has compared this species with *Myliobatis nieuhofi*, Bl. Schn., and remarked that among other features it differs therefrom by the spotted instead of striped disposition of the blue colour. This colouration is variable, and is much affected by age, the younger examples being, as Günther remarks,* more ornamental in colouration. All the specimens brought home are small, measuring less than two feet across the disc ; in such, the markings are very distinct and in the form of lines and spots, the anterior lines are the first to break up, and the posterior ones are much more persistent. In some larger examples obtained, beyond the general disposition of the spots—lines did not occur—such resembled the markings as figured by McCoy.

Another character emphasised by this author is that of the teeth, and he compares the width of the median lamellæ with their length, remarking that whereas the proportions in *M. nieuhofi* are 3 or $3\frac{1}{2}$ to 1, in *M. australis* the figures are $7\frac{1}{2}$ to 1. This again does not appear to be a very stable character, for as Günther also remarks :—"The young differ much from the adult, having no median series of larger teeth, but all the teeth of equal size and regularly sexangular." The proportions in our examples are about 5 to 1, or midway between those of the two species mentioned. The width of the disc is also intermediate, being proportionately less than in *M. nieuhofi*, and more than in *M. australis.*

Under these circumstances I strongly incline to regard these species as identical, *M. nieuhofi* having priority ; but in the absence

* Günther—Study of Fishes, 1880, p. 345.

of a verified example for comparison or the necessary literature, hesitate to take the extreme step.

Our records show in a very marked and interesting manner the character of the ground frequented by this Ray. It will be noticed that it was taken in consecutive hauls from Station 20 to 26, and not again was it met with until the trawl was shot at Station 50, whence it was again uninterruptedly taken to Station 54. The first series was on the sand and mud flats of Newcastle Bight, and the second similar ground in the Shoalhaven Bight and Jervis Bay. Of fifteen Stations, only three were outside this area—namely, Station 1, on the sand banks at the mouth of the Hawkesbury River; Station 10, a little further north, where the soundings showed a sandy run; and Station 58, on the muddy ground off Port Hacking.

Its geographical range on our coast, as far as ascertained, is from Jervis Bay in the south, nearly to Port Stephens in the north, and its vertical range from 10 to 48 fathoms. It is, however, commonly taken in 7 fathoms or under within the harbour of Port Jackson.

HOLOCEPHALI.

Family CHIMÆRIDÆ.

CHIMÆRA, *Linnæus.*

CHIMÆRA OGILBYI, *Waite.*

GHOST SHARK.

(Plate vi.)

Chimæra ogilbyi, Waite, "Thetis" Prelim. Report, 1898, p. 56.

Stations 35, 37, 46.

When the trawl was raised at 10 p.m. on March 10th the kerosene flares revealed the presence of two Chimeras. This haul (Station 35) was made within two miles of land, just outside Bate Bay, and directly off Port Hacking, in from 22 to 38 fathoms of water. Both these specimens were females, and as I much wanted to secure a male, Mr. Farnell kindly consented, on the following day, to run over the same ground; rock was, unfortunately, encountered as soon as the trawl was lowered, and on hauling it up it was found that the only fish taken were three Dories. After mending the net in Botany Bay another haul (Station 37) was made, this time further out, in 50-52 fathoms,

and I was extremely pleased to find four more Chimeras in the trawl—again all females. No more examples were met with until March 16th, when at Station 46, off the old ground, in the deeper waters of 66-50 fathoms, a seventh specimen was secured, which, strangely enough, proved to be another female.

This addition to our fauna is of peculiar interest, inasmuch as it is the first record of a member of the genus occurring south of the equator in the eastern hemisphere.

Although allied to a deep-water North Atlantic form, our Chimæra is sufficiently distinct to merit specific recognition, and in proposing the name *Chimæra ogilbyi* I have in mind the numerous and valuable contributions to Australian Ichthyology of Mr. James Douglas Ogilby of this city. The species may be described as follows :—

Length of head 4·19, greatest height of body (in front of the pectorals) 5·4 in the total length, measured to the end of the dorsal fin. First dorsal fin subcontinuous with the second, the connecting membrane very low, the respective length of their bases 14 : 37 ; combined they are 1·31 of the total length. The spine, which measures one-fifth less than the length of the head, is sub-acute at the base, thence laterally compressed, and keeled in front for the greater part of its length distally ; behind it is grooved, the lateral borders of the distal half are beset with curved spines directed backward and downwards; the first dorsal ray is somewhat longer than the spine; the anterior rays coalesce, but the two posterior ones are distinct. The second dorsal fin is low, rounded behind, and clearly separated from the caudal. The pectoral is falcate, with the inner angle rounded and deeply notched at its insertion with the fleshy base below ; the total length of the fin is one-half, and its membraneous portion one-seventh longer than the head ; it reaches beyond the insertion of the ventrals. The ventrals originate midway between the tip of the snout and the end of the dorsal fin. They are truncated behind and are shorter than the head, being contained 1·7 times in its length. In the median line behind the ventrals is a fatty organ longitudinally grooved. There is no distinct anal fin, its membrane being continuous with that of the caudal and extending rather further than the upper membrane: caudal produced into a rayless filament. The lateral line posterior to its cephalic subdivision makes two sharp angles, thence passes in small regular undulations, but on the tail becomes straight ; it takes a median course until just in advance of the termination of the dorsal fin, when it abruptly passes to the lower side and is thus continued along the filament. The course of the lines on the head, together with the position of the main mucous pores, is shown in the accompanying figure.

Teeth.—The anterior lamellæ in the upper jaw have a sinuous margin and each is formed of six to eight enamel rods, the columnar structure being plainly visible. The palatine pair have their outer edges roughly denticular and their flat surfaces each raised into three tubercles, one before and two behind ; the tubercles are white and enamel-like ; the rest horn-colour. The lamellæ in the lower jaw have the margin incised by three deep clefts, one median and two lateral, leaving four rounded prominences, of which the submedian pair are smaller and more acute. The columnar structure is not so evident as in the upper series, and is traceable only in the above named cusps. A long, low white enamel elevation runs backward from behind each of the outer or posterior cusps.

Colour.—Silvery above and on the sides, yellowish below. Membrane of the fins bluish-black ; the bases of the pectorals and ventrals horn-colour ; tip of the snout black ; eye yellow ; lateral line raised, brown ; caudal filament yellow. The markings take the form of narrow bands passing obliquely from behind forwards and downwards ; they are confined to the head and the anterior part of the body, and are formed of brown splashes which below become rings ; they extend across the chin and the base of the pectoral fins. Above the lateral line the whole body is marked with narrow transverse broken lines, about 25 in number ; those on the tail oblique.

Length to end of dorsal fin 670 mm., to end of caudal filament 860 mm. (the filament is, however, incomplete.)

This new species differs, first, from *C. monstrosa*, Linn., by having shorter pectorals, no distinct anal fin, the snout more produced, the hinder margin of the second dorsal rounded, and the tail fins less developed ; second, from *C. affinis*, Capello, by its sub-continuous dorsal fins and longer pectorals, by having the tail produced into a long filament and the fins much lower ; also by the truncated character of the ventral fins and probably in the form of the dorsal spine. It also differs in hue, being of a beautiful silvery colour, adorned with splashes and circles ; *C. affinis* being described as uniformly plumbeous. It is further to be remarked that whereas *C. ogilbyi* occurs in shallow water, *C. affinis* is the only Elasmobranch known from depths exceeding 1000 fathoms.

The chief interest of this record is not that of a new species, but rather the extension of the geographical range of a genus in itself of great interest.

The earliest described species, *C. monstrosa*, is known from the coasts of Europe, West and South Africa, the Azores, and Cuba, and also from Japan. It is taken only in deep water. *C. affinis*, first described from Portuguese specimens, was afterwards taken

off the American coast, northward of Cape Cod, where it is not uncommon in 200-1200 fathoms.

We now record *C. ogilbyi* from the coast of New South Wales in shallow water (22-66 fathoms). Into what depths this fish may journey, or what unconjectured forms may exist in the abyssmal regions off our shores, remains for the future to reveal.

The genus *Hydrolagus* is represented by the single species *H. colliei*, Bennett; it is found only on the Pacific coast of North America, and is abundant about Puget Sound and South-eastern Alaska. This species swims at the surface, and is common about wharfs, while there is no evidence that it descends to very considerable depths.

Two species of *Harriotta* have been described, namely, *H. raleighana*, Goode and Bean, from the eastern coast of North America, in depths ranging from 707 to 1,081 fathoms, and *H. pacifica*, Mitsukuri, from Japan.

Of *Callorhynchus*, hitherto the only representative of the family in Australian waters, two species also are known, *C. antarcticus*, Lacép, from the Antarctic basin and the South Pacific, and *C. argenteus*, Philippi, recently described from the coast of Chili.

In my Preliminary Report I wrote a paragraph on the errors and misprints of the literature of the family *Chimæridæ*, and reproduce the same below.

In "Oceanic Ichthyology," one of the most recent and pretentious publications on fishes, an extremely good figure of *Chimæra colliei* in the "Voyage of the Blossom" has been copied, but in some unaccountable way has been named *Callorhynchus antarcticus*, and so printed in the table of contents, notwithstanding the fact that it is correctly described in the text. By a typographical error *Hydrolagus* appears as *Hydbolagus colliei*. In the description of *Chimæra affinis* the following conflicting statements occur:—"The pectorals extending to the outer axil of the ventrals." And, again, "the pectoral terminating much in advance of the ventral.

In a French edition of "Cuvier's Animal Kingdom," the fishes by Valenciennes, an extraordinary figure is given on pl. 113, purporting to be of *Chimæra monstrosa*, and said to be drawn from nature, the locality given being the seas of Iceland. The peculiarity is that, though the figure, as a whole, represents *Callorhynchus*, the snout lacks the characteristic appendages. As *Callorhynchus* is a southern type, how came the artist to represent this genus from a specimen taken in the seas of Iceland? Is *Callorhynchus* a bipolar form, or had he access to southern material?

Lastly, an amusing misprint occurs in Macleay's "Fishes of Australia." This reads:—"Ventral organs confluent into two pairs of laminæ in the upper jaw and into one pair in the lower." The passage becomes clear when "Dental organs" is read.

TELEOSTOMI.

Family LEPTOCEPHALIDÆ.

CONGERMURÆNA, *Kaup.*

CONGERMURÆNA HABENATA, *Richardson.*

Congrus habenatus, Rich., Voy. Ereb. & Terr., Ichth., 1844, p. 109, pl. l., figs. 1-5.

Station 9.

A small example, measuring 150 mm., was obtained to the north of Broken Bay, where the trawl was dragged in 28 fathoms. This eel bears traces of having been in the stomach of some other fish, a dory possibly, as many were secured in this haul. It is a rare form on our coast, and is characterised by having a tail longer than the trunk, for which Ramsay and Ogilby have proposed the name *Congromurœna longicauda.** In other respects it cannot be said to differ from Richardson's species.

OPHISURUS, *Lacépède.*

OPHISURUS SERPENS, *Linnœus.*

Murœna serpens, Linn., Syst. Nat., ed. xii., i. 1766, p. 425.
Ophisurus serpens, Schleg., Fauna Japon., Pisces, 1850, p. 264, pl. cxv., fig. 1.

Although previously determined from Australia, with Port Jackson as a definite locality (Macleay), this species is very rare in our waters. Throwing a line off the jetty at Port Stephens I landed an example measuring 770 mm. (= 30 inches), which so well resembles the above quoted figure that it might have been the model; the relationship the body bears to the tail is 29 : 49. Richardson remarks† :—"The *Ophisurus rostratus* or *Ophisure long museau* of Quoy and Gaimard, Voy. du Freycinet, pl. 51, fig. 1, seems to be allied to *serpens*." If the former species is correctly represented it must be very distinct; while the head bears some resemblance, the free portion of the tail is much longer and the short stout body is not comparable with the snake-like form of *O. serpens*. This latter species is the only recognised member of the genus *Ophisurus* as now restricted.

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* Ramsay & Ogilby—Proc. Linn. Soc. N.S.W., xii., 1888, p. 1022.

† Richardson—Voy. Ereb. & Terr., Ichth., 1844, p. 106.

Family CLUPEIDÆ.

CLUPANODON, *Lacépède.*

CLUPANODON NEOPILCHARDUS, *Steindachner.*

PILCHARD.

Clupanodon neopilchardus, Steind., Denk. K. Akad. Wein. Wiss. xli., p. 12.

Station 26.

As we have not the above quoted work in our library I am unable to refer to the description of this species; for the same reason I am debarred from consulting many other papers by Dr. Steindachner.

The only Pilchard obtained by the "Thetis" was a partially digested example ejected by a dory.

Family SYNODONTIDÆ.

TRACHINOCEPHALUS, *Gill.*

TRACHINOCEPHALUS MYOPS, *Forster.*

Salmo myops, Forst. MS. Bloch and Schneider, Syst. Ichth. 1801, p. 421.

Saurus trachinus, Schleg., Fauna Japon., Pisces, 1850, p. 231, pl. cvi., fig. 2.

Station 23.

By no means uncommon in and around Port Jackson, this species appears not to have been recorded from elsewhere in Australian waters. Considering its wide distribution, it should be found on the eastern, northern and western seaboards. The only example taken in the trawl of the "Thetis" was netted in 16-19 fathoms off Newcastle.

SYNODUS (*Gronow*), *Bloch & Schneider.*

SYNODUS TUMBIL, *Bloch.*

Salmo tumbil, Bloch, Ichth. iv. 1797, p. 112, t. 430.

Saurus undosquamis, Rich., Voy. Ereb. and Terr., Ichth. 1844, p. 138, pl. li., figs. 1-6.

Station 21.

Our example was trawled in Newcastle Bight in 28-40 fathoms and measured 456 mm. (18 inches) in length. To the already

long synonomy must, I think, be added *Saurida australis*, Cast.,* and *Saurida truculenta*, Macl.,† both described from specimens taken in Port Jackson.

Family AULOPIDÆ.

AULOPUS, *Cuvier.*

AULOPUS PURPURISSATUS, *Richardson.*

SERGEANT BAKER.

Aulopus purpurissatus, Rich., Icon. Pisc., 1843, p. 6, pl. ii., fig. 3; McCoy, Prod. Zool. Vict., Dec. vi., 1881, pls. 54, 55.

Stations 7, 12.

The two Stations at which this fish was trawled were off Port Jackson, in 62-69, and off Broken Bay, in 23-34 fathoms respectively. It was also taken with the line at three other places, namely:—Schnapper Rock, south of the Manning River; off Broughton Islands, north of Port Stephens; and southward, off Shoalhaven Bight. Although doubtless well known from the first-named localities, I am inclined to think that it has not been absolutely recorded so far north before.

CHLOROPTHALMUS, *Bonaparte.*

CHLOROPTHALMUS NIGRIPINNIS, *Günther.*

CUCUMBER FISH.

(Fig. 4).

Chloropthalmus nigripinnis, Günth., Ann. Mag. Nat. Hist., (5), ii. 1878, p. 182, and Chall. Report, Zool., xxii., 1887, p. 193, pl. li., fig. A.

Stations 4, 13, 37, 38, 41, 42, 43, 46, 47, 48, 49, 56.

Since the Challenger expedition obtained two examples in 120 fathoms off Twofold Bay, numbers of this species have once or twice been taken in the trawl outside Port Jackson in about 70 fathoms. We found it to be very common indeed, especially to the southward of Botany Bay, where the trawl was lowered thirteen or fourteen times. It was not taken far northward of Broken Bay (Station 13) nor southward of Wollongong (Station 49), and never in less than 41 fathoms, while it was most numerously obtained at the deepest trials.

* Castelnau—Proc. Linn. Soc. N.S.W., iii., 1879, p. 393.

† Macleay—Proc. Linn. Soc. N.S.W., vi., 1882, p. 219.

It may be pointed out that few of the northern stations indicate depths greater than 40 fathoms, while none of the southern ones (50-55) exceeded 20 fathoms. *Chloropthalmus* was, therefore, trawled at nearly all Stations registering a depth inhabited by it, as ascertained by our observations, and it is pretty certain that it is extremely common all along our coast line to the northern limit of its range.

As to its vertical range, Günther remarks:—"This fish shows nothing to indicate its bathybial life beyond the excessively large eye; and it is not likely that it descends to any more considerable depth than that from which it was obtained" (*loc. cit.*, p. 194). This deduction receives considerable support from our own experiences which would suggest that the range of the species is from 40 to 150, rather than from 120 to 500 fathoms.

Günther's description was made from rather small examples which, judging from the figure, were imperfect. The following is drawn up from a specimen measuring to the end of the central caudal rays 210 mm. ($=8\frac{1}{4}$ inches).

B. vii. D. 11. A. 9. V. 9. P. 16. C. 9+8. L. lat. 48.
L. tr. 4+6.

Length of head 3·66, height of body 4·75, in total length (caudal excluded). Diameter of eye 2·6 in the length of the head. Interorbital space flat, but bounded by two supraorbital keels, and one-third the diameter of the eye. Snout shorter than the eye contained 1·66 times in its diameter. Head low, triangular, with obtuse snout and three enamel-like keels above, one median, from the snout to between the orbits, and one above each eye, not, however, as long as their diameter; there is a scale-like process in front of the eye immediately behind the nostril, and directed upwards and backwards. Anterior portion of snout slightly tumid. Nostrils close together, a little nearer the eye than the end of the snout, the anterior small, protected by a valvular flap which covers it from behind, posterior nostril larger and simple. Cleft of mouth slightly oblique, lower jaw the longer, the maxillary reaches nearly to beneath the centre of the eye, its distal extremity equal to the interorbital space. Opercles entire.

Teeth.—Bands of villiform teeth in the jaws, on the vomer, palatines and tongue, and a patch within the symphysis of the lower jaw.

The first dorsal ray is slender, little more than half the length of the second, which is stouter; both are undivided. The second ray is the longest of the fin, and equals the head in length; the remainder are regularly reduced so that when the fin is raised its hind margin is straight; the last ray is inserted exactly midway between the end of the snout and the base of the caudal rays, and the whole base is rather more than half the

length of the head. The pectoral reaches to below the base of the last dorsal ray, is 1·24 in the length of the head, and equal to the ventral, which reaches to below the tip of the second dorsal ray when depressed; the inner ray extends almost to the vent, placed midway between the end of the lower jaw and the tips of the central caudal rays. The anal arises below the centre of the space marked by the bases of the last dorsal and the caudal rays; its first ray is simple, and shorter than the second, which measures but slightly more than the second dorsal, and is a fifth higher than the base of the anal. Adipose fin situated immediately but wholly behind the vertical from the last anal ray. Caudal deeply cleft, the upper lobe a third longer than the lower, the longest rays equal in length to the pectoral: pedicel almost round, its height two-thirds that of the second anal ray.

Scales cycloid, thin and nearly smooth, with radiating and concentric striæ, those of the lateral line, which runs evenly along the central line of the body, with a simple tubercle more apparent in the region of the caudal. Cheeks and upper part of opercle scaly, head otherwise naked; rows of minute scales occur along the outside of the ventral rays, at the base of which fin is an elongate axillary scale. Caudal covered with small scales.

Colours.—Above green, below silvery-yellow, the opercles brilliant silver, snout and eyes dark green, upper lip sky-blue, distal portion of the second to fourth dorsal rays black, a clouded patch near the end of the ventrals. Upper lobe of caudal narrowly, lower lobe broadly, edged with black.

As in one or two particulars Günther's figure does not well represent our fishes, such discrepancies may be mentioned. The profile from the eye to the dorsal is convex, not concave as drawn; the upper angle of the distal portion of the maxillary is acute, not rounded as shown, and is a little longer. The adipose fin is situated wholly behind the base of the anal; in the figure it is represented well within the margin. Lastly, the tail is far from correctly shown: the accompanying sketch (Fig. 4), drawn from the example above described and of the actual size, illustrates the true outline. The upper lobe is very much longer than the lower and less margined with black; the inner margins of the fin are rounded: in the figure criticised the lobes are represented of equal size, are coloured alike, and are acutely pointed.

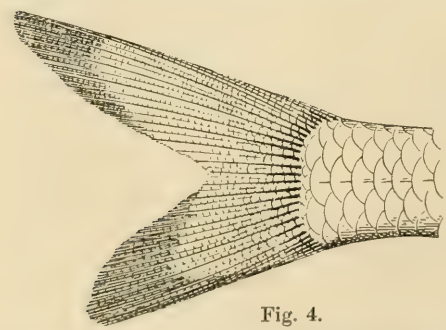

Fig. 4.

In Goode's genus *Hyphalonedrus** (since regarded as synonymous with *Chloropthalmus*), the tongue is stated to be entirely smooth. With reference to this Günther writes:—"The only point in which Dr. Goode's diagnosis apparently differs from that given by me in Fish., Vol. v., p. 403, is that he denies the presence of lingual teeth. However, these teeth are so minute in *Chloropthalmus agassizii* as to require a magnifying glass to find them, and therefore may easily be overlooked" (*loc. cit.*, p. 192). In our examples of *Chloropthalmus nigripinnis*, the lingual teeth are very noticeable, and can be seen by the unaided eye: they occur in a narrow band which embraces the front and sides, leaving the central portion naked.

Family EXOCŒTIDÆ.

EXOCŒTUS, *Linnæus.*

EXOCŒTUS EVOLANS, *Linnæus.*

Flying Fish.

Exocœtus evolans, Linn., Syst. Nat., ed. xii., 1766, p. 521. Day, Fishes of India, 1878, p. 519, pl. cxx., fig. 5.

During the gale we encountered off Wollongong on March 16th two Flying Fishes were blown aboard, and in a similar manner we obtained another on our way to Lord Howe Island. They are of the same species and belong to the genus *Exocœtus*, characterised by the small size and forward position of the ventral fins. As *E. evolans*, the type of Linnæus, and *E. volitans*, are the same species, *Exocœtus* and not *Halocypselus*, Weinland, is the correct name of the genus. The larger example, measuring 150 mm., in no wise differs from the figures and descriptions; the smaller one, which is but 45 mm. in length, possesses the barbel common to immature specimens, and has a black blotch at the base of the rays of each ventral fin. It has also two dark bands towards the caudal, and the general colour of the body, instead of being of uniform tint, is represented by dots only, another indication of immaturity and a feature common to very many fishes.

Flying fishes were met with all along the area traversed; sometimes shoals were seen in the distance, when they appeared like glittering specs passing through the air, generally all in one direction; at other times they rose from beneath our bows, evidently disturbed by the passage of the vessel, and scattered all ways.

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* Goode—Proc. U.S. Nat. Mus., 1881, p. 483.

They reminded me of nothing so much as a flock of little birds scudding over the surface. They did not rise over the water more than four or five feet, which elevation was quickly attained. The course was not at all a trajectory, but quite horizontal, and after very careful watching I came to the conclusion that the length of "flight" was not less than 250 yards, but sometimes individuals would not travel more than a few feet. The method of returning to the water was very sudden, being accompanied by a splash, and the whole passage of the fish was extremely rapid.

That this power of "flight" is not denied to young individuals is shown by the fact that our smaller example, measuring but one and three-quarter inches in length, was accompanying the flock when cast on deck.

Under the heading "Flying-fish, *Exocœtus volitans*," White wrote*:—"This fish is so well known to naturalists, and is so frequently seen in every voyage, that it is unnecessary to give a particular description of it." Whether this fish, of which a recognisable figure is given, was obtained off this coast or not, is by no means clear, and the species has not therefore been included in the fish literature of the Colony.

Family FISTULARIIDÆ.

FISTULARIA, *Linnæus.*

FISTULARIA SERRATA, *Cuvier.*

ROUGH-BILLED PIPE FISH.

Fistularia serrata, Cuv., Règne Anim. (after Bloch). Günth., Chall. Report, Zool., i., 1880, p. 68, pl. xxxii., fig. c.

Station 17.

In describing this species as common in Port Jackson, Ogilby† voiced the general impression conveyed by the literature of the subject. A careful study of the collection in the Museum shows that whereas *F. depressa*, Günth., is well represented, we have but few examples of *F. serrata*, under which name nearly all the specimens had been registered. All remarks in Australian literature should, therefore, probably apply to *F. depressa*. This latter species was taken by the "Challenger" in the Sulu Archipelago. The trawl had been down to 250 fathoms, but

* White—Voyage to New South Wales, 1790, p. 295, pl. lii., fig. 2.

† Ogilby—Cat. Fish, N.S.W., 1886, p. 42.

Dr. Günther writes :—(*loc. cit.*) "I am inclined to doubt the occurrence of this shore fish at so great a depth as 250 fathoms, and it does not seem to me to be improbable that this specimen got into the trawl when near to the surface of the water."

Off Broughton Island the "Thetis" trawled a fine example of *F. serrata* in 29-48 fathoms : on the other hand, we have received from Mr. Henry Newcombe, this species, taken with hook and line at Coogee, on the coast, a few miles south of Port Jackson. Both these specimens were of a beautiful terra-cotta colour when first obtained.

Family MACRORHAMPHOSIDÆ.

MACRORHAMPHOSUS, *Lacépède.*

MACRORHAMPHOSUS SCOLOPAX, *Linnæus.*

var. ELEVATUS, nov.

BELLOWS FISH.

(Plate vii., fig. 1.)

Centriscus scolopax, Linn., Syst. Nat. ed. xii., 1766, i., p. 415. Day, Fishes of Great Britain and Ireland, i., 1880-84, p. 249, pl. lxix.

Macrorhamphosus scolopax, Goode & Bean, Ocean. Ichth., sp. Bull. U.S. Nat. Mus., 1895, p. 483, pl. cxvii., fig. 396.

Stations 2, 4, 9, 13, 17, 20, 21, 25, 37, 38, 41.

This species proves to be quite common off the coast of the colony, although not previously recorded. It was obtained at eleven stations, and altogether about fifty specimens were taken. Its distribution on the New South Wales coast, as determined by our observations, is from south of Port Hacking to Broughton Island ; and its vertical range from 23 to 84 fathoms. Allport (MS.) recorded it from Tasmania, but Johnston * remarked : "It is questionable whether the Tasmanian species may not be *C. humerosus*, Rich. I have not yet examined any local specimens." Under *C. gracilis*, Macleay wrote † : "*C. scolopax* I have never seen here. Mr. Johnston's *scolopax* is probably this species." Johnston, however, later, set the question at rest as follows ‡ :

* Johnston—Proc. Roy. Soc., Tas., 1882, p. 123.

† Macleay—Proc. Linn. Soc., N.S.W., ix., 1894, p. 42.

‡ Johnston—Proc. Roy. Soc., Tas., 1884, p. 255.

"I was fortunate in obtaining a fine specimen of *Centriscus scolopax* . . . . captured at Port Sorell. All my doubts about its existence in Tasmania are now set at rest."

It seems possible that *M. gracilis*, Houtt., is more pelagic in habit than *M. scolopax*. The former species has been at odd times taken in Port Jackson and on the beach at Maroubra Bay by my colleague, Mr. T. Whitelegge; it has never been taken in deep water. *M. scolopax*, on the other hand, is known on our coast in not less than 23 fathoms, as recorded above. While, as also shown, it was freely taken in 84 fathoms. It would certainly be found at much greater depths if trials were made, for on the Banc d' Arguin the members of a French exploring expedition obtained it from 130 fathoms. In this connection it is mentioned as surprising that "as many as ten individuals were caught."

Gunther* draws attention to the variability of the relative length of the second dorsal spine. Our examples are characterised by the extreme length of the spine and the greater height of the body as compared with European specimens. In the latter the height of the body is rendered as half the length of the head, or four-sevenths to three-fifths of the distance from the operculum to the base of the caudal. Similarly the length of the dorsal spine is given as three-fifths to three-eighths of the same.

In Australian representatives the height of the body is 1·42 in the length of the head and 1·55, or fully two-thirds, in that of the body as above measured. A greater disproportion is exhibited by the spine; whereas in the Old World form its length is three-fifths to three-eighths the length of the body, in ours it is 1·3 or about five-sixths of the length; when adpressed it extends to or beyond the caudal rays.

As it is easier to grasp proportions as projected in an illustration than the numerical proportions not so projected, the accompanying figure (Pl. vii., fig. 1) may be compared with those rendered by, say Day† and Goode & Bean.‡

Our race, with extreme development, perhaps bears the same relationship to *M. scolopax* that *M. gracilis* does to *M. japonicus*, and as the latter has received a name since regarded as varietal, I propose for the Australian representative of *M. scolopax* the term *elevatus*.

The radial formula is :—

D. 5/12. A. 19. V. 1/5. P. 14. C. 6 + 9 + 6.

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* Günther—Cat. Fish. Brit. Mus., iii., 1861, p. 520.

† Day—Fishes of Great Britain and Ireland, i., 1880-84, pl. lxix.

‡ Goode & Bean—Oceanic Ichth., sp. Bull. U.S. Nat. Mus., 1895, pl. cxviii., fig. 396.

It will be noticed that the ventral rays are preceded by a spine; this is more than half the length of the rays. It may have been overlooked in European examples, and also in *M. gracilis*, in which, as I have ascertained, from specimens collected on our coast, it is likewise present. Richardson has also duly noted it in *M. humerosus*.*

The maximum length of the "Thetis" examples is 140 mm.

As no illustration of *M. gracilis* (available to Australian students) has ever been published, I figure the species on pl. vii., fig. 2, from an example obtained by Mr. T. Whitelegge at Maroubra Bay in April, 1897.

Family SYNGNATHIDÆ.

SOLENOGNATHUS, *Swainson.*

SOLENOGNATHUS SPINOSISSIMUS, *Günther.*

SPINY SEA-HORSE.

Solenognathus spinosissimus, Günth., Cat. Fish., Brit. Mus., viii., 1870, p. 195. Waite, Proc. Linn. Soc. N.S.W. (2), ix., 1894, p. 222, pl. xvii., figs. 5 and 8.

(Fig. 5).

Stations 46, 49, 56.

We have hitherto known the members of this genus only from solitary examples cast on the beaches after stormy weather, a circumstance which sufficiently indicates that they are inhabitants of deep water. The "Challenger" obtained *S. fasciatus* off Twofold Bay in 120 fathoms, and we netted four examples of *S. spinosissimus* at depths ranging from 50 to 80 fathoms. At the latter depth (Station 56) a male was trawled bearing ova; these were fully ripe, and from the anterior part of the specialised area the young had escaped, and the flaccid skin was resuming its normal condition. Further back, however, the ova still remained to the number of thirty-eight. In some instances the enclosed young broke through the integument and escaped into the vessel in

* Richardson—Voy. Ereb. & Terr., Ichth., 1844, p. 56.

which the parent was placed, and killed in formol. Reaching Sydney a few days later it was found that all the ova had become detached, the form and condition of the *pseudo-marsupium* (if I may so term it) was, however, perfectly preserved. I am now able to add to my previous note; I there remarked that during the breeding season this ova-bearing space becomes flaccid and thrown into ridges, forming shallow pits. These pits are, however, not so shallow as I had imagined, and embrace rather more than one-half of the ovum. Anteriorly the pits are arranged in six transverse series, while posteriorly the series is four; sixteen body scutes are involved, and altogether about eighty cells are developed. The appearance produced is quite that of the honeycomb; the cells are about the size of a worker-bee cell, but not so deep. When charged with ova the surface was tolerably even, and the upper edge of each ovum, projecting from the cell, was glued to its fellows.

Each ovum in its ripe condition is of ovoid shape, and measures 6 mm. × 4 mm.: the enclosing membrane is quite transparent, and the young is seen to be coiled around the yolk sac, while the dark markings on the body form a conspicuous feature (Fig. 5B). When alive the young ones frequently changed their position within the egg; one which ruptured the membrane and became free may now be examined. It measures 35 mm. in length, and the head is fixed at right angles to the long and slender body. This with the short snout at once recalls the condition in *Hippocampus*.

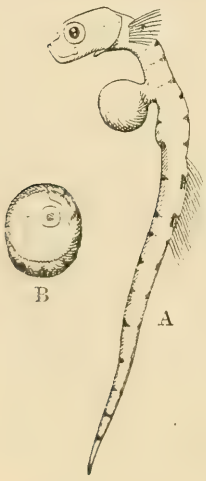

Fig. 5.

The snout is not longer than the diameter of the eye. The bony plates are already developed, but do not yet bear spines. The yoke sac is attached, but 3 mm. behind the head; the seven bars so noticeable in the adult are quite distinct, while on the sides and the lower surface other markings exist, of which one only—that in the preanal region—persists in after life (Fig. 5A).

The example previously referred to as having been obtained at Maroubra Bay was taken on March 4th, 1894. Our specimen was trawled on March 22nd, 1898, off Botany Bay, and supports the opinion there expressed that autumn is the breeding season.

The fish taken at Station 42 was of the slender form I had thought characteristic of *S. fasciatus*, and I so named it in the Preliminary Report. A closer inspection, more especially as to the nature of the spines, shows that it is none other than the commoner *S. spinosissimus*.

ERRATUM.

Page 63, for CREEDIADÆ read CREEDIIDÆ.

Family CREEDIADÆ.

CREEDIA, *Ogilby.*

(Fig. 6).

Creedia clathrisquamis, Ogilby, Proc. Linn. Soc. N.S.W., xxiii., 1898, p. 299.

Station 33.

Of this species, previously known only from the type specimen, we secured a single example; it was taken on the sandy stretches of the Newcastle Bight in 24-27 fathoms. It is larger than the type and measures 52 mm. in length, but differs otherwise only by having the lower jaw the longer, possibly a sexual difference, and being of more pronounced colour; the smaller fish is colourless, with a few minute black spots along the base of the anal fin; my example is brown, with a circular mass of spots on the occiput and a row of spots near the margin of each scale.

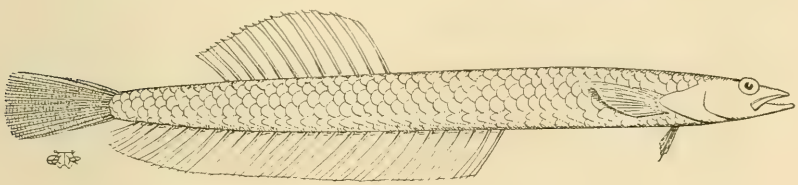

Fig. 6.

This specimen gives me the opportunity of figuring the species (the accompanying cut, Fig. 6, being twice the natural size), and of more fully describing the individual scales. The ordinary scale of the body does not present any peculiarity, being of the usual cycloid type; it is shown at Fig. 6A. The scales of the lateral line are very peculiar, each has a broad insertion and is much narrowed at the free margin, the lower edge is straight but the median third is serrated, the teeth averaging about seven in number. The upper margin of the scale is irregular and towards its free or posterior half, deeply excavated; the space thus formed is partially occupied with

Fig. 6A.

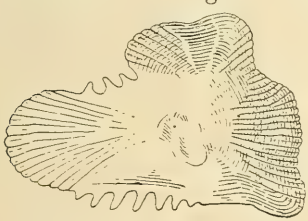

Fig. 6B.

denticles, much less numerous than those of the lower margin and generally three in number. In *situ* the narrowed portion of the scale, including the denticles both above and below, is visible, but the broadened anterior portion is hidden by adjacent scales. Fig. 6B shows the exact condition of a scale removed from the middle of the lateral line, greatly enlarged.

Family TRACHICHTHYIDÆ.

TRACHICHTHYS, *Shaw.*

TRACHICHTHYS ELONGATUS, *Günther.*

LONG ROUGHY.

Trachichthys elongatus, Günth., Cat. Fish. Brit. Mus., i., 1859, p. 10. Chall. Report, Zool., xxii., 1887, p. 22, pl. v. fig. c.

Station 8.

In the Deep Sea Fishes of the "Challenger," Günther wrote:—"The two typical specimens, of which one, 4 inches long, was found near the Great Barrier Island (New Zealand), seem still to be the only ones known." The habitat of the smaller example is vaguely stated as Australia. On Feb. 22nd, we were fortunate in netting two examples off Barranjoey. They were obtained in 25-28 fathoms, and the largest specimen measures 130 mm. ($=5\frac{1}{8}$ inches), or one-fourth longer than the larger of the British Museum types.

The black bands along the caudal lobes mentioned by Günther, but not shown in his figure, are prominent features of our examples, which, however, do not bear the bands mentioned in the "Challenger" Report as existing in front of the soft dorsal and anal fins. This latter character is not mentioned in the original description. As ascertained by fresh specimens the marks consist of a pale brown dorsal band which extends from the head to the caudal, sharply defined from the lower silvery part at half the distance of the lateral line from the dorsal profile; the opercles, otherwise silvery, are blotched with brown. The brown bands on the caudal lobes are connected at their bases by a recurved dark line showing through the scales.

PARATRACHICHTHYS, gen. nov.

This new genus is formed for the reception of *Trachichthys trailli*, Hutton, and is characterised by the circumstance of the vent being situated in front of, instead of behind the abdominal scutes, as in members of the genus *Trachichthys* as now restricted.

PARATRACHICHTHYS TRAILLI, *Hutton.*

Trachichthys trailli, Hutton, Trans. N.Z. Inst., viii., 1887, p. 212.
Günther, Chall. Report, Zool., xxii., p. 23, pl. lv., fig. A.
Trachichthys macleayi, Johnston, Proc. Roy. Soc. Tas., 1880, p. 56.

Station 25.

The single specimen obtained differs only from the descriptions of this species by having thirteen in place of eleven abdominal scutes. If this could be regarded as of specific value the name would be *T. macleayi* as above. It may be noted that the first scute is provided with two spines, which lie one on each side of the first median series, a character not shown in the figure quoted, nor mentioned in Johnston's description. With regard to the discrepancy in the number of scales along the lateral line, it may be mentioned that they are by no means easy to count. Our fish exhibits fifty-five pierced scales ; Hutton counted ninety-five in the type, and Johnston "about fifty" in *T. macleayi*. The total number of scales along the line is one hundred and eighteen, exactly Hutton's rendering. None of these are larger than those on the rest of the body as described by Johnston.

Regarding the position of the vent, which is placed between the ventral fins, in front of the series of abdominal scutes, Günther considered it as probably abnormal. Such an opinion can no longer be held, as the condition is maintained by our specimen. I therefore propose generic recognition in the name *Paratrachichthys.*

If we accept Johnston's fish as referable to *P. trailli*, five examples are now known, the distribution of the species being ascertainable as follows :—

The type was obtained near Stewart Island, New Zealand ; other two, also from New Zealand, were described and figured by Arthur* from specimens taken in Otago Harbour ; the type of *M macleayi* was described from a Tasmanian example taken in the estuary of the River Derwent.

The "Thetis" individual, which adds a new species to the Australian fauna, was obtained off Newcastle on March 4th, in 42-48 fathoms on a soft muddy bottom. It may have been taken in the neighbourhood of wreckage, as the anchor, planks and other material of the ship "Alhambra," sunk there twelve years previously, were also hauled aboard. It is of interest to note that it is the second species only taken *in situ ;* all others, with the exception of *T. intermedius*, have been obtained floating on the

* Arthur—Trans. N.Z. Inst., xvii., 1885, p. 162, pl. xiv., fig. 2.

water. When brought to the surface the membranes about the eyes were inflated and the stomach had been forced into the mouth, a condition common to fishes taken from considerable depths.

The claims of *Hoplostethus* to generic separation from *Trachichthys* are based mainly on the absence of vomerine teeth; in *T. trailli* the patch could be covered by a pin's head. Goode and Bean* have made the distinction apparently greater by erroneously crediting *Trachichthys* with but two instead of three anal spines.

Family BERYCIDÆ.

BERYX, *Cuvier.*

BERYX AFFINIS, *Günther.*

NANNYGAI.

Beryx affinis, Günth., Cat. Fish., Brit. Mus., i., 1859, p. 13; Tenison Woods, Fish., N.S. Wales, 1882, p. 51, pl xv.

Stations 7, 11, 12, 13, 21, 22, 23, 24, 25, 35, 42, 48.

Goode and Bean write:† "*Beryx lineatus* and *B. affinis* of Günther belong to the Australian fauna, and are said to occur in water of no very considerable depth." In what shallow water *B. affinis* may on occasions be taken, however, would be scarcely imagined. Some data on this subject may therefore be of interest.

During the expedition we did not obtain it in less than 16-19 fathoms (Station 23), but it is commonly caught off the coast by the line fishermen in 10-12 fathoms. While trawling in Port Jackson itself with the Museum gear, we have secured it in 7 or 8 fathoms, at which depth it has also been taken on the line, so that it is quite a surface species.

We have no information as to the depths to which it may descend. It was taken by us freely at 80 fathoms and doubtless inhabits the deeper water between our coast and New Zealand, where it also occurs, thence ranging to Tasmania.

While trawling on sandy bottom we obtained only small examples, but when the soundings showed rock we netted larger individuals. The northern range of this species on our coast is unknown; we failed to secure it northward of Newcastle Bight.

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* Goode and Bean—Oceanic Ichth., Sp. Bull. U.S. Nat. Mus., 1895, p. 187.

† Goode and Bean—*loc. cit.*, p. 175.

Family MONOCENTRIDÆ.

MONOCENTRIS, *Schneider.*

MONOCENTRIS GLORIA-MARIS, *De Vis.*

KNIGHT FISH.

(Plate viii., figs. 1 and 2.)

Cleidopus gloria-maris, De Vis, Proc. Linn. Soc. N.S.W., vii., 1882, p. 368.

Monocentris gloria-maris, Ogil., Proc. Linn. Soc. N.S.W., xxiv., 1899, p. 159.

Stations 5, 10, 28, 29.

At each of the above mentioned stations we obtained an example of this fish. It was taken northward of Port Jackson at depths varying from 17 to 84 fathoms. In life the mandibulary luminous organs were of bright crimson colour with a brilliant white line along the upper edge: in spirits the discs of two examples have turned brick-red, in the other two a pearly-grey; all four exhibit the white line. These discs are situated externally one on each side of the mandible, are fully exposed when the mouth is open, but completely concealed by the maxillary when closed. The organ is subreniform in shape and measures 6 mm. in length and 3 mm. in depth in examples 200 mm. in length.

The dorsal spines are normally six in number, but one, two, or even three of the posterior ones may be undeveloped and represented only by the rugose portion found at the base of each spine. They are markedly heterocanth in character and are subject to variation as follows. While in some examples the first spine is directed to the right, the second to the left, and so on throughout the series, in others the condition is reversed, the first spine tending to the left, the second to the right, and so on alternately; in other words, we might say they are either right or left handed. All the spines are joined to each other by a low but very strong membrane.

The ventral spines, when erected, have an almost horizontal aspect, and can be securely locked at right angles to the body; the mechanism by which this locking is effected has been fully described in *M. japonicus* by Thilo in his admirable treatise.* These spines are of enormous size and strength, and in a specimen measuring 190 mm. in total length the pair when erected compass 130 mm. from tip to tip.

* Otto Thilo—Morph. Jahrb., xxiv., 1896, p. 336.

In the paper above quoted, Ogilby has reinstated De Vis' species, but as some of the contrasted characters are ill-founded I will first deal with these. I have before me two small examples of *M. japonicus*, obtained from Japanese seas, so that my comparisons are actual, and herein I have the advantage, as Ogilby had not seen Japanese material.

The characters relied upon as specific were the nature of the teeth, the presence of luminous organs in Australian specimens, and the condition of the armament.

Teeth.—With the exception of a rather different contour, consequent on the varied shape of the jaws, to be referred to later, the teeth of the two forms are quite similar, with the proviso that in *M. gloria-maris* there is a small rounded patch on the vomer. This is absent in the Japanese form.

Luminous organs.—These have been fully described in our species, and I need not further refer to them, excepting to remark that the mandibulary discs are most conspicuous objects. I can find no trace of such organs in *M. japonicus;* this is therefore an important specific difference.

Scales.—The character of the scales has not been insisted on, but the writer quoted draws attention to the fact that the author of the ichthyological portion of Lydekker's "Royal Natural History" writes of *Monocentris japonicus* as having the scales articulated together so as to form a solid armature, and adds :— "The statement is not, so far as I am aware, confirmed by other authors."

A comparison shows that such differences as occur in the scales are to be found in the sculpture, and not in the method of implantation or connection. In the small Japanese specimens at my disposal the scales are more imbricate than in the larger Australian examples, but the numerous figures of *M. japonicus* certainly indicate the black skin which separates the scales, so that no great imbrication occurs. It is to be mentioned, however, that the scales of the caudal pedicel are imbricate, while towards the lower surface the scales in both species are not only imbricate but are firmly locked together. Actual fusion scarcely occurs, for in the smooth groove into which the ventral spine is received the sutures between the scales can still be traced.

Some further points of difference may now be considered. I have no record of the size to which *Monocentris japonicus* attains, but from the various accounts accessible, it seems to be a much smaller species than ours, which reaches 230 mm. (9 inches) in total length.

If my Japanese examples are immature, the less ornate character of the scales may be thus explained. In the Australian species

the scales are much more rugose, the spines comparatively longer and more jagged There is also a tendency to rugosity in otherwise smooth places, such as the snout, top of the head, post orbitals, opercles, etc., and the width of the snout is much less; whereas in *M. japonicus* the single scale on the isthmus is narrow; in *M. gloria-maris* it is triangular and very broad at its base. The greatest differences, however, are presented by the mouth parts. In the former species the suborbital is deep, almost as deep as the eye, and the distal end of the maxilla is considerably dilated, its width half the depth of the eye. In the latter the suborbital is reduced to a narrow strip of bone, so that when the mouth is shut the maxilla is pressed close to the subocular border. This alone produces a considerable difference in what I may term the countenance or expression of the two fishes. The maxilla also is scarcely dilated. In Japanese examples the profile of both upper and lower jaw is almost straight and normal. In our specimens both are curiously bent, the whole mouth is greatly widened, and the premaxillæ are bent downwards towards the centre, each half widely separated from its fellow; above it is excised to receive a process from the preorbital; the mandible is remarkably thickened and bent; the symphysis is depressed, and at its lateral third the bifurcation occurs, mentioned by Ogilby, the two limbs embracing the luminous disc; the external limb ceases at the posterior margin of the disc, and is limited by a deep notch; the inner limb is greatly elevated above the disc.

Another subject which seems worth mentioning, and may indeed be of considerable interest, is the colour of the membrane lining the mouth. In *M. japonicus*, as far as I can gather, this presents no peculiarity; in *M. gloria-maris* it is quite black. It has been pointed out by several writers that this colour is quite common to the lining membrane of fishes from deep water, and is apparently correlated with luminous organs. It is in such connection that we now observe it in the Australian *Monocentris*.

Family MULLIDÆ.

UPENEICHTHYS, *Bleeker*.

UPENEICHTHYS POROSUS, *Cuvier & Valenciennes*.

Red Mullet.

Upeneus porosus, Cuv. & Val., Hist. Nat. Poiss., iii., 1829, p. 455.
Upeneichthys valmingii, Hector, Trans. N.Z. Inst., ix., 1876, p. 465, pl. ix., fig. 5.

Stations 1, 12, 21, 22, 24, 27, 28, 29, 39, 48.

Although frequently exposed in the Sydney Fish Market, members of the *Mullidæ* can scarcely be accounted common on the

coast. All the specimens obtained were attributable to *U. porosus*, although the very nearly allied *U. signatus*, Günth., is usually accounted the commoner species. This may be in part explained by observing that whereas the former has a wide distribution, *U. signatus* has not been recorded on the coast, other than from Port Jackson and Botany Bay.

Family SCOMBRIDÆ.

SCOMBER (*Artedi*), *Linnæus.*

SCOMBER PNEUMATOPHORUS, *De la Roche.*

MACKEREL.

Scomber pneumatophorus, De la Roche, Ann. Mus. Hist. Nat., xiii., 1809, pp. 315, 334. McCoy, Prod. Zool. Vict., Dec. iii., 1879, pl. xxviii.

Station 38.

The only example obtained was a partially digested individual ejected by a Dory as it lay on deck. On the Mackerel being recognised a sharp look-out was kept for Mackerel shoals, but not a living example was seen.

SARDA, *Cuvier.*

SARDA CHILENSIS, *Cuvier & Valenciennes.*

HORSE MACKEREL.

Pelamys chilensis, Cuv. & Val., Hist. Nat. Poiss., viii., 1831, p. 163.
Pelamys schlegeli, McCoy, Prod. Zool. Vict., Dec. xvi., 1888, pl. clv.

Stations 17, 27.

Originally described from the coast of Chili, and known also from Japanese, Indian and Australian Seas, yet the only recorded Australian habitats are Port Phillip in Victoria, whence a single example has so far been made known, and the Port Jackson district in New South Wales, where it is quite common. Its known range on our coast is now extended considerably northward.

Station 17 is off Broughton Island, north of Port Stephens, while Station 27 is much further north, off the Manning River, and was the most northern point at which the trawl was lowered Some of the specimens obtained were in spawn.

Family CARANGIDÆ.

SERIOLA, *Cuvier.*

SERIOLA LALANDII, *Cuvier & Valenciennes.*

King Fish.

Seriola lalandii, Cuv. & Val., Hist. Nat. Poiss., ix., 1833, p. 208. McCoy, Prod. Zool. Vict., Dec. xviii., 1889, pl. clxxii.

This fine fish was freely taken by the line off Seal Rocks, and afforded good sport to such members of the expedition as were not at the time engaged in repairing the trawl.

The interest of fishing and of net-mending was, however, greatly eclipsed by the excitement aroused in watching the seals *(Otaria forsteri)* to the number of one hundred or more. As the "Thetis" steamed close up to the rock, the movements of these animals as they fought with one another or otherwise disported themselves, were followed with the keenest interest.

SERIOLA HIPPOS, *Günther.*

Samson Fish.

(Plate ix.)

Seriola hippos, Günth., Ann. Mag. Nat. Hist., (4), xvii., 1876, p. 392. Ogil., Edible Fishes, N.S.W., 1893, p. 85.

Riding at anchor on March 1st, in Port Stephens, where we had been driven by stress of weather, we were entertained for some time by a herd of *Seriola hippos*. The fishes raced around the "Thetis," sometimes within arm's length, and jumped clear out of the water apparently with keen enjoyment. They reminded me very much of Dolphins (*Delphinus*).

So favoured were our opportunities for observing them that there could be no doubt as to the species, they being readily distinguishable from their nearest ally of our waters, *S. lalandii*. On returning from my cabin, whither I had gone for a gun, the shoal had disappeared, but was afterwards seen a few hundred yards away.

S. hippos has, as far as known, a very restricted distribution, and the present record extends the range considerably to the northward.

Previously the habitat was stated as follows :—"So far as can be ascertained from public records and from our own experience, the purely Port Jackson district, stretching from Broken Bay in the north to Port Hacking in the south, can alone be given as the acknowledged habitat of this species on our coast."* (Ogilby).

The accompanying plate is drawn from a young example, measuring 200 mm. ($7\frac{7}{8}$ inches) in total length. In specimens of this size, and smaller, two or three rows of very large scales are present above the eye. In older examples they become obsolete, as do also the dark bands on the dorsal surface and sides. These bands are not always constant in number or position, and the two sides of the fish figured, are dissimilar ; on the left side, as shown, they are six in number, situated, one over the eye, one on the occiput, one beneath the spinous dorsal, two below the soft dorsal and one on the caudal peduncle. The right side differs in having an additional band, there being three beneath the dorsal rays. None of the bands reach the ventral profile, but that on the caudal is faintly produced across the peduncle.

The scales on the body are too minute to be indicated in a drawing of a fish as small as that illustrated.

TRACHURUS, *Rafinesque.*

TRACHURUS DECLIVIS, *Jenyns.*

Yellow-tail.

Caranx declivis, Jenyns, Zool. Beagle, Fish., 1842, p. 68, pl. xiv.

Stations 17, 24, 26, 39.

One scarcely expects to meet with this fish while trawling, and indeed those secured were obtained under quite adventitious circumstances. Few of them were perfect, the others were damaged due to having been more or less digested by some carnivorous fish. On two occasions partially digested examples were ejected by Dories, and as these latter fishes are known to be predatory feeders, it is possible that most of the Yellow-tails were secured by their efforts and the remainder taken as the trawl approached the surface. All the specimens secured were small, not exceeding 6 inches in length.

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* Ogilby—Edible Fishes, N.S.W., 1893, p. 86.

Family POMATOMIDÆ.

POMATOMUS, *Lacépède.*

POMATOMUS SALTATRIX, *Linnæus.*

TAILOR.

Perca saltatrix, Linn., Syst. Nat., Ed. x., i., 1758, p. 293.
Temnodon saltator, McCoy, Prod. Zool. Vict., Dec. xix., 1889, pl. clxxxiii.

Stations 1, 23.

Probably encountered as the trawl neared the surface, two examples were taken; had the season been spring, instead of autumn, more might have been caught, but the seine and not the trawl is the correct implement to be used for this species. At any time it is scarcely a favourite with fishermen on account of the damage it does to their nets, and its habits in this direction have locally earned for it the name Tailor.

Family PEMPHERIDÆ.

PEMPHERIS, *Cuvier & Valenciennes.*

PEMPHERIS MACROLEPIS, *Macleay.*

BULLSEYE.

(Plate x.)

Pempheris macrolepis, Macl., Proc. Linn. Soc. N.S.W., v., 1881, p. 517.
Pempheris lineatis, Ogil., Proc. Linn. Soc. N.S.W., x., 1886, p. 447.

Station 10.

By the kindness of Mr. George Masters, Curator of the Macleay Museum, I have examined the author's types of *P. macrolepis*. They are not in good condition, and have lost most of the scales. On comparing with them the type of *P. lineatis*, I do not see any grounds for regarding this latter species as distinct. Macleay identified his own species from Port Jackson.

Our examples, three in number, were obtained in 28 fathoms off Broken Head. They have lost all their scales except those of the lateral line, which alone are very adherent. Being thus

unfitted for delineation the accompanying figure has been drawn from the type specimen of *P. lineatis*, which is in excellent preservation.

P. mülleri, Klz., and *P. multiradiatus*, Klz.,* are more nearly allied to *P. compressus*, White†, from which, indeed, they are doubtfully distinct.

Family CHEILODIPTERIDÆ.

APOGONOPS, *Ogilby.*

APOGONOPS ANOMALUS, *Ogilby.*

(Plate xi., fig. 1.)

Apogonops anomalus, Ogil., Proc. Linn. Soc. N.S.W., xxi., 1896, p. 24.

Stations 55, 57.

This species was twice obtained, first off Crookhaven River, north of Jervis Bay, and again off Wata Mooli, south of Botany Bay. These with the type are the only examples known. Both are larger than the type, and measure 58 and 70 mm. respectively. The larger example taken off Crookhaven River was trawled in 11-15 fathoms, and the smaller was brought from the depth of 54-59 fathoms.

ENOPLOSUS, *Lacépède.*

ENOPLOSUS ARMATUS, *White.*

Old Wife.

Chætodon armatus, White, Voyage to New South Wales, 1790, pl. xxxix., fig. 1.

Enoplosus armatus, Cuv. & Val., Hist. Nat. Poiss., ii., 1828, p. 133, pl. xx.

Stations 18, 22, 26.

Although this common little fish is best known swimming around the wharfs and jetties of the harbours, it is, as our records show, not confined to shallow water, having been taken in 48 fathoms. It cannot be obtained in large quantities, for it occurs chiefly in rocky ground where the net cannot be used, and it very seldom

* Klunz—Sitz. der K. Akad. Wissen., Wien., lxxx., 1879, p. 380-1.

† White—Voyage to New South Wales, App., 1790, p. 267, fig. 2.

takes the hook. It does not usually attain to a length greater than eight or nine inches. The only three examples obtained in the trawl were taken between Newcastle and Port Stephens.

Family SERRANIDÆ.

ACANTHISTIUS, *Gill.*

ACANTHISTIUS SERRATUS, *Cuvier & Valenciennes.*

WIRRAH.

Plectropoma serratum, Cuv. & Val., Hist. Nat. Poiss., ii., 1828, p. 399.
Plectropoma myriaster, Steind., Sitzb. K. Akad. Wiss. Wien., liii., 1866, p. 426, pl. i., fig. 3.

Station 25.

The only two examples secured were obtained by the trawl in 48 fathoms, in the vicinity of a wreck, the anchor-chain and a plank of which were hauled aboard. Although easily caught with the hook and tolerably common, the Wirrah is accounted of little value for the table; it is said to be good only when boiled. It appears to be a very local species, confined to the coast of New South Wales, and more common in the vicinity of Port Jackson than elsewhere. Our specimens were trawled off Newcastle.

EPINEPHELUS, *Bloch.*

EPINEPHELUS SEPTEMFASCIATUS, *Thunberg.*

GREY-BANDED PERCH.

Perca 7-fasciata, Thunb., Vetensk. Akad. Handl. Stockholm, xiv., 1793, p. 56, pl. i.
Plectropoma susuki, Temm. & Schleg., Fauna Japon., Pisc., 1844, p. 11, pl. iv., fig. 1.

Station 51.

In 1867 two specimens of this fish were sent from Sydney to London. These are, I believe, the only examples previously known from Australia. I am therefore pleased to be able to once more record it from our waters; it is a fine fish, attaining a length of 12 inches. The only example trawled was taken in Shoalhaven Bight in 15 fathoms or under. While apparently rare in Australian seas, it has a wide distribution, ranging from the tropical Atlantic through the Indian Ocean to the Chinese and Japanese Seas.

HYPOPLECTRODES *(Poey), Gill.*

HYPOPLECTRODES SEMICINCTUS, *Cuvier & Valenciennes.*

HALF-BANDED SEA PERCH.

Plectropoma semicinctum, Cuv. & Val., Hist. Nat. Poiss., ix., 1833, p. 442. Guich, Gay's Hist. Chile, Zool., ii., 1848, p. 153. Ictiol, pl. ii., fig. 1.

Not taken in the trawl. A single example was secured by hook and line on the reef off Cape Hawke in company with rock-frequenting fish.

Under the impression that the term *Hypoplectrodes*, Gill, was a *nomen nudum*, Mr. Boulenger, in his catalogue,* used the name *Gilbertia*, Jord. and Eigen, for the genus. Dr. Gill thereupon pointed out† that his diagnosis had been published by Professor Poey, and should therefore be used.

CÆSIOPERCA, *Castelnau.*

CÆSIOPERCA LEPIDOPTERA, *Forster.*

BASTARD LONGFIN.

Epinephelus lepidopterus, (Forst.), Bloch & Schneider, Syst. Ichth., 1801, p. 302.
Scorpis hectori, Hutton, Fish. New Zeal., 1872, p. 4, pl. i., fig. 4.

Station 15.

A single specimen has been recorded from Port Jackson; this is in the Macleay Museum and was taken in 1895. Since that time the Australian Museum has received one or two examples from the mouth of the Hawkesbury River. This species was obtained by the "Thetis" Expedition off Tuggerah Lakes in 32-48 fathoms in one haul only, when but two examples were taken. I was rather surprised not to have trawled it at some of the southern Stations, as it appears to be a southern form with its headquarters off the Tasmanian coast, whence it journeys into New Zealand waters.

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* Boulenger—Cat. Fish. Brit. Mus. (2nd ed.), i., 1895, p. 306.

† Gill—Proc. U.S. Nat. Mus., xviii., 1896, p. 568.

CAPRODON, *Temminck & Schlegel.*

CAPRODON LONGIMANUS, *Günther.*

LONGFIN.

Anthias longimanus, Günth., Cat. Fish. Brit. Mus., 1859, i., p. 94.
Caprodon longimanus, Boul., Cat. Fish. Brit. Mus., (2nd Ed.), i., 1895, p. 315, pl. xii.

Stations 15, 42, 48, 56, 57.

On the Australian coast this species has been recorded only from Port Jackson, and our observations extend its range but slightly. Bungaree Norah (Station 15), between Broken Bay and Newcastle, marks its northern limit, while the southern range is extended to Wollongong (Station 48). It occurred in rather deep water, being taken between 32 and 80 fathoms, on sand, mud, or rock.

ANTHIAS, *Bloch.*

ANTHIAS PULCHELLUS, sp. nov.

(Plate xii.)

Stations 15, 42, 48, 49.

B. vii. D. x. 16-17. A. iii. 8. V. i. 5. P. 16. C. 17. L. lat. 44. L. tr. 5/14.

Length of head 2·8, height of body 2·47 in the length of body (caudal excluded). Snout scaly, shorter than the eye and 4·6 in the length of the head. Eye 3·6 in the same. Interorbital space scaly, flat, 1·2 in the diameter of the eye and 3·75 in the length of the head.

The upper profile of the head is slightly concave; the first dorsal spine marks the highest point, whence the descent is a gentle curve to the caudal pedicel; the ventral profile is less convex. The lower jaw projects beyond the upper and the cleft of the mouth is very oblique. Maxillary scaly, reaching to below the first fourth of the orbit, its distal breadth slightly more than half the diameter of the eye. The anterior nostril has a skinny rim; the posterior one is a simple opening and situated midway between the orbit and the anterior nostril. Opercle armed with three spines, of which the middle is the longest. Both limbs of preopercle finely serrated, those at the angle not enlarged.

About 26 long and slender gill-rakers on the lower limb of the first arch; pseudobranchiæ well-developed.

Teeth.—At the symphysis of the upper jaw and just within the mouth is a pair of canines strongly recurved and appreciably separated. On the outer margin of the jaw is placed a pair of widely separated canines; these are strong, conical and directed horizontally forward; a few smaller teeth are also to be found scattered between the two pairs of canines and one or more rows of cardiform teeth on the front margin of the jaw. In the mandible the anterior canines are smaller and sometimes in two pairs; in the middle of the lateral series are one or two pairs of strong, recurved canines. The teeth on the vomer form a large Λ-shaped patch, those of the palatines a broad band: the tongue and entopterygoids toothless.

Fins.—The dorsal commences above the middle opercular spine; the spinous and soft portions are of equal height; the former has the longer base by about one-tenth. The spines are strong, the fourth being the longest, 2·1 in the length of the head and twice the length of the first spine; the second is 1·4 in that of the fourth, to which the third is almost equal; the others are subequal with the exception of the last two, which are somewhat shorter; anteriorly the inter-spinous membrane is deeply notched. The soft portion is higher than the posterior spines, but the longest ray (the 11th) does not exceed the fourth spine. The anal spines are very strong; the second is the longest, but nearly equalled by the third; it is as long as the third dorsal; the first dorsal and first anal are alike in size and character. The anal rays are much longer than those of the dorsal, the longest (second and third) being 1·7 in the length of the head. The ventral spine is slightly longer than the fourth dorsal; the second ray, which is the longest, fails to reach the vent and is 1·4 in the length of the head. The pectoral is elongate and subsymmetrical; rays branched near their extremities; the middle ray, the eighth, is the longest, and reaches the base of the third anal spine; the whole fin is longer than the head by one-tenth; the caudal is crescentic; the outer rays are not produced, and the lobes are equal.

Scales rather large; those covered by the base of the pectoral measure 10 mm. along their exposed edge in the largest example; they are closely ciliate and firmly adherent. The bases of all the fins are scaly, as is also the entire head, including the branchiostegals.

The lateral line, after rising to beneath the fourth dorsal spine, follows the curvature of the back to beyond the fin, bending horizontally to the caudal pedicel; the tubules are simple, and extend along nearly the entire scale; there are five series of scales

between the first dorsal spine and the lateral line, and three between the line and the middle dorsal spines; the least height of the caudal pedicel measures one-third the length of the head.

Colours generally red, but turning brown in spirits, each scale of the upper portion with a dark mark in the centre; these form longitudinal lines; along the middle line of the body is a broad ill-defined yellow band; cheeks yellow, with a pink band below the eyes; fins yellow; a black blotch situated on the 1-6 dorsal rays may be present or absent; irides crimson, with an orange ring.

Total length of largest example, caudal included, 223 mm.

The position and affinities of this new species may be best ascertained by comparing it with the synopsis of species as published by Boulenger.*

The circumstance of the head being completely scaly places it in division II., and the nature of the lateral line limits it to subsection B, while the number of scales between the dorsal spines and the lateral line suggests that it is one of two species, namely, *A. hypselosoma* and *A. pleurotænia*, the former recorded from Lord Howe Island and the latter from the north-east coast of Australia.

The variation in the dorsal rays (16-17) of *A. pulchellus* is a little striking, the two examples possessing the black blotches have seventeen rays, the other two but sixteen; both agree, however, in possessing eight anal rays; those of the two species above mentioned have seven only. In all cases I count the last divided ray as a single one; otherwise the number would be nine. On account of its peculiarities *A. pleurotænia* may be dismissed from consideration. I was at first inclined to write down the "Thetis" examples as *A. hypselosoma*. They are, however, distinct from the specimen of that species identified by Ogilby with *A. cichlops*,† and possess features irreconcilable with the descriptions.

In addition to the increased number of rays in the anal it differs from its nearest ally in the length of the maxillary, the sub-equal character of the preopercular serrations, the longer pectoral and shorter anal, the extra number of scales between the dorsal spines and the lateral line. Also, apparently, by the character of the teeth, the colouration, and, as far as known, by attaining much larger dimensions.

It is also to be remarked that the pectoral has but sixteen rays, a character common to all four specimens; while the pectoral formula for the genus is seventeen-eighteen.

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* Boulenger—Cat. Fish. Brit. Mus., (2nd ed.), i., pp. 321-2.

† Ogilby—Proc. Zool. Soc., 1889, p. 151.

This new species was taken on four occasions, extending from Bungaree Norah, south of Newcastle, to Wollongong, and at depths between 32 and 78 fathoms.

CALLANTHIAS, *Lowe.*

CALLANTHIAS PLATEI, *Steindachner.*

Callanthias platei, Steind., Fauna Chilensis, Zool. Jahrb., Supp., iv., 2, 1898, p. 284, pl. xv.

Station 15.

Shortly after the publication of the Preliminary Report* with reference to the species provisionally referred to *C. allporti*, Mr. J. D. Ogilby placed on my table a reprint of Dr. Steindachner's paper on the Plate Collection, open at page 284. We jointly decided that the species there described was identical with the "Thetis" examples.

Next followed Boulenger's note on *Callanthias*,† wherein, on reference to my pen and ink sketch, he expresses his opinion that the Chilian and Australian species are the same. In his interesting note he further draws attention to several species common to Eastern Australia and Chili, and suggests that in future closer comparison be instituted between the fishes of the western and eastern parts of the South Pacific than has hitherto been the case.

Then Ogilby, looking up a specimen he had obtained in 1897, made a critical comparison of the two forms, and proposed for Australian specimens the trinomial *Callanthias platei australis*.‡

We trawled six examples, attaining a length of 205 mm. off Norah Head, 36 miles north of Port Jackson, in 32-48 fathoms. They may have been netted among rocks, as obstructions were encountered which rendered the raising of the trawl a necessity. According to Dr. Plate, however, as quoted by Steindachner, they are also of pelagic habit, as indicated by the following passage:—"Although by no means abundant, this species surrounds the island of Juan Fernandez in large shoals of many hundreds of individuals. From the edges of the tablelands I have seen such swarms of fish that they appeared a dense mass under the surface of the water, like golden spots in the remoter distance."

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* Waite—"Thetis" Prelim. Report, 1898, p. 31.

† Boulenger—Ann. Mag. Nat. Hist., (7), iii., 1899, p. 346.

‡ Ogilby—Proc. Linn. Soc., N.S.W., xxiv., 1899, p. 173.

Family PRIACANTHIDÆ.

PRIACANTHUS, *Cuvier.*

PRIACANTHUS MACRACANTHUS, *Cuvier & Valenciennes.*

RED BULLSEYE.

Priacanthus macracanthus, Cuv. & Val., Hist. Nat. Poiss., iii., 1829, p. 108.
Priacanthus benmebari, Temm. & Schleg., Fauna Japon., Pisc., 1844, p. 19, pl. vii., fig. 1.

Stations 22, 23.

This species was but twice obtained in the trawl, having been encountered in 16-40 fathoms off Newcastle. It is believed that in the autumn this fish leaves the sea and passes up the rivers for the purpose of spawning.

Family THERAPONIDÆ.

THERAPON, *Cuvier.*

THERAPON CUVIERI, *Bleeker.*

TRUMPETER PERCH.

Pristipoma sex-lineatum, Quoy & Gaim., Voy. Freyc., Poiss., 1824, p. 320.
Therapon cuvieri, Bleek., Atlas Ichth., vii., 1873-6, Perc., pl. xxxvii., fig. 2.

Station 52.

One specimen only was obtained, in 20 fathoms, off Shoalhaven Bight. If examples of this fish were required we should prefer drawing the seine at Botany Bay or Middle Harbour. Around the shores of Port Jackson it is a very common little fish, and is frequently caught by boys on the wharves, in company with *Trachurus declivis* and *Neosebastes australis.*

Family SPARIDÆ.

SPAROSOMUS, *Gill.*

SPAROSOMUS AURATUS, *Bloch & Schneider.*

SCHNAPPER.

Labrus auratus, Bloch & Schneider, Syst. Ichth., 1801, p. 266.
Pagrus unicolor, Tenison Woods, Fish and Fisheries N.S.W., 1882, p. 39, pl. viii. and frontispiece.

Stations 1, 2, 8, 12, 15, 21, 23, 29, 33, 52, 53.

Judging by the inquiries made as we on the several occasions entered port, a stranger might have thought that there was only one fish in our waters, and that the Schnapper. We were by no means anxious to obtain this fish, for its advent was a tolerable indication that we were in the vicinity of rocks, objects of all others to be avoided in trawling. At four out of the above eleven Stations the net was badly torn, and at several of the other Stations, where the damage was less severe, the numbers of Sponges, Gorgonias, and other rock-frequenting forms sufficiently indicated the nature of the obstruction encountered. Occasionally, Schnapper were obtained on ideal trawling-ground. It was, however, then significant that not more than one or two individuals were netted.

The circumstance of Red Bream (young Schnapper) of 2 lb. weight in full breeding condition was considered to be of great interest and considerable importance. Taking into account the number of small Schnapper secured in such mature condition, we can scarcely believe that this phase of Schnapper life is unknown to fishermen.

CHRYSOPHRYS, *Cuvier.*

CHRYSOPHRYS AUSTRALIS, *Günther.*

BLACK BREAM.

Chrysophrys australis, Günth., Cat. Fish. Brit. Mus., i., 1859, p. 494. McCoy, Prod. Zool. Vict., Dec. i., 1878, pl. iv.

Considering the comparatively large number of Stations at which the Schnapper was secured, one might have expected that

one Black Bream at least would have been trawled; such was, however, not the case. On the other hand, this experience is quite in accord with the known habits of the species, frequenting the coastal and estuary areas rather than the more open seaway. Lines put down on the recognised Schnapper grounds failed to secure them, and they were obtained only in the sheltered harbour of Port Stephens.

Family GERRIDÆ.

XYSTÆMA, *Jordan & Evermann.*

XYSTÆMA OVATUM, *Günther.*

Silver Belly.

(Plate xiii.)

Gerres ovatus, Günth., Cat. Fish. Brit. Mus., i., 1859, p. 343, and iv., 1862, p. 257.

Station 23.

The only specimen secured was taken off Newcastle, in 16-19 fathoms. It is a very common fish in shallower water, where it frequents the long sandy reaches.

An examination of all the specimens available to me shows that the species is referable to the genus *Xystæma*, characterised by having the second interhæmal spine solid (and therefore not receiving a horn of the air bladder as in *Gerres*), and by the preopercle being entire.

The fish taken is that commonly identified as *Gerres ovatus*, Günth. Although it very generally agrees with the description of that species, there are one or two points of difference which call for remark. In *G. ovatus* the anal fin terminates behind the dorsal; in our example, in advance of it. The suborbital groove in Günther's species does not extend beyond the anterior margin of the eye; in our form considerably beyond it. In Ogilby's description of *G. ovatus** the dorsal and anal fins are said to be without scaly sheaths. This sheath is present in our specimens, which in such particular agree with the original description. The

* Ogilby—Edible Fishes, N.S.W., 1893, p. 147.

scales are extremely deciduous, and it is very rare to meet with a perfect specimen; the accompanying plate is from a beautiful example kindly lent me by Mr. Ogilby.

Family KYPHOSIDÆ

CÆSIOSOMA, *Kaup.*

CÆSIOSOMA ÆQUIPINNIS, *Richardson.*

SWEEP.

Scorpis æquipinnis, Rich., Voy. Ereb. & Terr., Fish, 1844, p. 121.
Scorpis lineolata, Kner, Reise Novara, Fische, 1869, p. 108, pl. v., fig. 3.

Not once having entered the trawl, this common species finds a place in the list by virtue of it having been taken at two places with the hook, namely, over Schnapper Rock, between Cape Hawke and Crowdy Head; and on Young Banks, the favourite Schnapper grounds off Crookhaven Bight.

Family SCIÆNIDÆ.

ATRACTOSCION, *Gill.*

ATRACTOSCION ATELODUS, *Günther.*

TERAGLIN.

Otolithus atelodus, Günth., Ann. Mag. Nat. Hist., (3), xx., 1867, p. 60. Tenison Woods, Fish and Fisheries N.S.W., 1882, p. 54, pl. xvii.

Stations 1, 11, 12, 23, 25.

This species, so extremely common on our coast, has not yet been recorded outside the limits of the Colony. Although sometimes taken in the seine, it is more often caught with the line at moderate depths. Of the dozen examples trawled none exceeded a foot in length, although it is known to attain to three times that size. Attention may be drawn to the fact that the soundings at all the above named Stations showed a sandy or muddy bottom, the depths ranging from 16 to 48 fathoms.

Family CIRRHITIDÆ.

LATRIS, *Richardson.*

LATRIS CILIARIS, *Forster.*

BASTARD TRUMPETER.

Sciæna ciliaris, Forst., Descr. Anim., Ed. Licht., 1844, p. 137.
Latris ciliaris, Rich., Voy. Ereb. & Terr., Fish., 1844, p. 37, pl. xxvi., figs. 6-7.

Station 53.

Having its headquarters in New Zealand waters, this species is scarce in our Colony, and when secured is only taken with hook and line. Dr. Hector,* writing of it in New Zealand waters, remarks, however, "it rarely takes the bait, but is chiefly caught with the net." Our line fishermen tell me that it is only taken on rocky bottom, and our single example was certainly secured in such situation, for no sooner had the trawl reached the ground than it became fouled and got rather badly torn. This occurred off Shoalhaven Bight in 23 fathoms.

DACTYLOSPARUS, *Gill.*

DACTYLOSPARUS CARPONEMUS, *Parkinson.*

MORWONG.

Sparus carponemus, Parkinson.
Cheilodactylus carponemus, Cuv. & Val., Hist. Nat. Poiss., v., 1830, p. 362, pl. cxxviii.
Chilodactylus carponemus, McCoy, Prod. Zool. Vict., Dec. xviii., 1889, pls. clxxiii., clxxiv.

Stations 7, 12, 21, 42, 48, 58.

It is to be noticed that although neither of the nearly-related fishes, *Dactylosparus macropterus*, nor the common *Chilodactylus*

* Hector—Edible Fish. N.Z., 1872, p. 108.

fuscus, was obtained, *D. carponemus* was gathered in considerable quantities. Hitherto almost unknown, excepting from adult examples, we were fortunate in netting young ones. Most of them were collected in deep water, say 45 to 75 fathoms, and none were got in less than 23 fathoms. Beyond enabling us to note the fact, our observations were not sufficiently extensive to empower us to form any definite opinion as to the breeding habits of this species, a subject at present quite unknown. Had operations been continued further southward we should probably have met with greater success with this species, as it is peculiarly a southern form, known from Victoria, South Australia, and New Zealand. Station 21, in the Newcastle Bight, is, I believe, the most northern point whence it has so far been recorded.

Family POMACENTRIDÆ.

HELIASES, *Cuvier & Valenciennes.*

HELIASES IMMACULATUS, *Ogilby.*

BROWN PULLER.

(Plate xiv.)

Heliastes immaculatus, Ogil., Proc. Linn. Soc. N.S.W., x., 1886, p. 446.

Station 30.

This species is closely allied to, if not identical with *H. hypsilepis*, Günth.,* the description of which, however, is insufficient for comparative purposes. It is to be noticed that our specimen, and also all others caught off the coast, have immaculate fins, and in this particular differ from the description of *H. hypsilepis*. Each body scale of our example bears at its basal portion a faint purple mark ; an appearance of longitudinal lines is thus produced.

The single representative was secured off Cape Hawke, in 35 fathoms, where the trawl encountered rock the moment it touched bottom.

* Günth.—Ann. Mag. Nat. Hist., (3), xx., 1867, p. 66.

Family LABRIDÆ.

OPTHALMOLEPIS, *Bleeker.*

OPTHALMOLEPIS LINEOLATA, *Cuvier & Valenciennes.*

RAINBOW FISH OR MAORI.

Julis lineolatus, Cuv. & Val., Hist. Nat. Poiss., xiii., 1839, p. 436.

Opthalmolepis lineolata, Kner, Reise Novara, Fische, 1869, p. 258, pl. xi., fig. 1.

This species was never taken in the trawl, but examples were secured by means of the line. It is not found northward of our Colony, but what its northern limit may be appears to be unknown.

I am, indeed, not certain that it has been previously recorded from, although doubtless taken off Schnapper Rock, between the Manning River and Cape Hawke, where we hooked several specimens.

NOVACULICHTHYS, *Bleeker.*

NOVACULICHTHYS JACKSONENSIS, *Ramsay.*

KEEL-HEADED PARROT FISH.

(Plate xv.)

Novacula jacksonensis, Rams., Proc. Linn. Soc. N.S.W., vi., 1882, p. 198.

Station 32.

This species was first made known from Manly, immediately north of Port Jackson, on March 22nd, 1881, since which date it had not been met with, until the 6th March, 1898, when we trawled a second individual in 10-12 fathoms, between Cape Hawke and Charlotte Head.

Having the type specimen also before me, I am able to compare the two, and find, apart from size, only the following differences :— In Ramsay's example, which is immature, the profile of the head slopes backwards, and the lower pair of canine teeth is developed equally with the upper, the second spine is quite detached from the third, but a glass reveals indication of a ruptured membrane between them.

In my specimen, well preserved in formol, the anterior profile is vertical and the lower pair of canine teeth is ill-developed. The two portions of the spinous dorsal are connected by a low membrane; the species thus enters the genus *Novacula* as restricted by Gill, or the *Hemipteronotus* of Bleeker.

The following is a description of the "Thetis" example:—

D. ii. vii. 12. A. iii. 12. P. 13. V. i. 5. C. 15. L. lat. 22 + 6. L. tr. 3/11.

Length of head 3·2, height of body 2·45 in total length (caudal excluded); the eye has a pronounced fleshy margin and is 5·2 in the length of the head; pectoral 1·2, and caudal rays 2·0 in the same.

From in front of the eye to the mouth, the profile of the head is almost perpendicular; passing upwards and backwards with a sweeping curve, the highest point of the body is attained at the base of the third spine; the dorsal profile is at first gently, afterwards more pronouncedly, convex to the end of the dorsal fin, whence it passes obliquely to the caudal rays. The ventral profile forms a more even but similar convexity. The height of the caudal peduncle is slightly more than its length behind the last dorsal ray.

The jaws are equal and the cleft of the mouth one-half longer than the diameter of the eye, and does not reach to its anterior margin. In front of the upper jaw is a pair of curved and divergent canine teeth directed somewhat forward. In the lower jaw is also a pair of canines; these are very short, close together, and bite between the upper ones. Behind the canine in each ramus of both jaws is a series of conical teeth to the number of eight or nine.

Nasal apertures very small, rather close together, the anterior with a low skinny rim nearer the eye than the edge of the snout, the posterior a horizontal fissure on a higher level. On the head are some scattered pores, the position of which are indicated in the accompanying figure. The anterior profile of the head forms a sharp keel, whose extent is circumscribed by a closely set series of shallow horizontal grooves. The eye is surrounded by a membrane which is widest above and below the posterior angles, where it is free behind.

The first dorsal spine is planted slightly behind the centre of the eye, and is a little shorter than the second, which is 2·35 times in the length of the head. This spine is remote from the third, but attached by a low membrane. The remaining spinous portion is low, but the rayed part uniformly increases in height, and the last rays, which are longer than the second spine, extend to the base of the

caudal rays. The anal commences beneath the first dorsal ray, and it is similar to the corresponding part of that fin, but is continued further back, and its posterior rays extend slightly beyond the base of those of the caudal. The pectoral arises from a fleshy base, its second and third rays are the longest and reach to above the third anal spine. The ventral extends to the vent, but the outer ray, which is produced, reaches to the origin of the anal. The caudal is truncate or slightly rounded.

Scales.—Four imperfect rows of small scales on the cheeks, those of the body are large, thin, and adherent, marked with faint radiating striæ. The tubules of the lateral line are simple and very low, and terminate in a large pore opening at some distance from the margin of the scale. The lateral line is interrupted on the twenty-second scale, and three rows lower is continued along six scales in the median line of the tail to within a scale of the caudal rays.

Colours.—In life the general colour was of an opalescent translucent salmon tint with oblique blue hair-lines on the dorsal surface, one to each scale, lost about the lateral line. Two or three rows of scales bordering the ventral fin and extending along the lower side of the caudal peduncle were marked each with a large blue blotch at its base. All the fins orange, the dorsal and anal marked with oblique wavy blue lines and the tail with five bars of the same colour. Eye orange. Preserved in formol the colours are the same, but have faded somewhat.

Total length of specimen 185 mm., the length of the type 132 mm.

Family ZEIDÆ.

ZEUS *(Artedi), Cuvier.*

ZEUS AUSTRALIS, *Richardson.*

DORY.

Zeus australis, Rich., Voy. Ereb. & Terr., Fish., 1846, pp. 36 and 138, pl. xxv., fig. 1.

Stations 2, 4, 5, 7, 8, 9, 11, 12, 15, 17, 21, 22, 23, 25, 26, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 46, 47, 48, 50, 52, 56, 57, 58.

Although retaining Richardson's name, I am strongly inclined to agree with Günther in regarding the species as identical with *Z. faber*, Linn. With a nice series before me most of the characters emphasised by Richardson are seen to be variable, and in some

examples such agree exactly with the descriptions of the old world species.

The dorsal spines are doubtfully shorter and stouter than in *Z. faber*, and the base of the soft portion is slightly less than that of the spinous. The spiny scutes at the base of the soft dorsal and anal fins vary in number from seven to eight. In all our examples the thoracic and abdominal scutes are strongly spinose, none at all reduced to the tuberculate character figured by Richardson.

As will be seen by a reference to the Stations quoted, Dories were trawled on no less than thirty-three occasions. At Station 36 they were the only fishes taken, and at Station 37, twenty-eight large individuals were obtained in one haul of two hours' duration immediately south of Botany Bay and within three miles of the coast. Depth, between the extremes at which we trawled, seemed to have no effect on its numbers, it being equally common either at 16 or 84 fathoms. Indeed, the known habits of the British Dory indicate that it may swim freely at the surface, for when the Pilchards appoach the shore this fish is often taken in considerable numbers. The only Pilchard obtained by us was voided by a Dory (Station 26), and the single Mackerel was obtained in the same way (Station 38), while, as has been previously mentioned, many of the Yellow-tails *(Trachurus declivis)* secured had been partially digested, doubtless by Dories. When these latter fish were in the trawl the fact was generally made apparent by numbers of dead examples rising to the surface and floating away (owing to their peculiar conformation) on their sides, many were washed over the ground line and thus lost.

Cunningham* writes:—"In the aquarium at Plymouth I have noticed that the dory has a peculiar and interesting method of securing its prey. It does not overtake it by superior speed like the mackerel, or lie in wait for it like the angler, but stalks it and approaches it by stealth. It is able to do this in consequence of the extreme thinness of its body, and the peculiar movement of its hinder dorsal and ventral fins. The dory places itself end on towards the fish it desires to devour, and in this position it is evident that it excites no alarm on the part of its prey. The appearance of the dory seen in this way is a mere line in the water, to which no particular significance can be attached. I have not particularly noticed the effect of the ribbons of membrane, which project from the dorsal fin. But I have observed that the movements of the dory are very gradual, except in turning: it alters the position of its body by a turn of the tail or side fins, and then slowly swims forward by vibrating the second dorsal and ventral, a movement which causes very

* Cunningham—Marketable Marine Fishes, 1896, p. 322.

slight disturbance of the water. The whole appearance of the dory in these actions is suggestive of suppressed excitement, his eyes being fixed on his prey. I do not recollect seeing him actually swallow another fish, but have no doubt that he gets near enough to a sprat for example, without alarming it, to seize it by the sudden elongation of his curious jaws."

Family MONACANTHIDÆ.

MONACANTHUS, *Cuvier.*

MONACANTHUS AYRAUDI, *Quoy & Gaimard.*

COMMON LEATHERJACKET.

Monacanthus ayraudi, Quoy & Gaim., Voy. l'Uranie, Poiss., 1824, p. 216, pl. xlvii., fig. 2.

Stations 1, 2, 4, 5, 7, 8, 9, 10, 11, 12, 15, 17, 20, 21, 22, 26, 27, 28, 33, 44, 52, 54, 57.

Previously the known range of this species was summed up in the following words :—"The only localities from which this species can be recorded with certainty are the metropolitan district of New South Wales and King George's Sound" (Ogilby). It was taken by us all along the coast line from the Manning River to Jervis Bay, and at all depths from 10 to 84 fathoms. Wherever lines were put over on the reefs this ubiquitous species was hooked, and proved as irritating as usual, cutting lines and gut with its sharp teeth, or monopolising the bait intended for Schnapper and other esteemed fish. Young and half-grown examples were freely netted, while the adults reached a length of 510 mm. (= 20 inches).

MONOCANTHUS SETOSUS, sp. nov.

(Plate xvi.)

Station 49.

D. 34. A. 34. P. 12. C. 12.

Length of head 3·7, height of body 2·3 (or 1·7 when ventral bone is extended), length of caudal 3·4 in the total. The eye is large, 2·8 in the length of the head, and equal to the interorbital space, which is slightly convex: it lies nearer to the snout than to the dorsal rays.

The gill opening is slightly oblique, placed under the centre of the eye and directed to its posterior margin; it is shorter than the eye and is separated therefrom by less than its own length. Nostrils approximate, each with a skinny margin, placed in front of the upper anterior angle of the eye.

The teeth are damaged. There are three pairs in the lower jaw.

Upper profile of head straight. From the spine to the rays the body is also straight and ascends very slightly, the first ray marking the highest point of the body, whence it descends in an even curve to the caudal pedicel. When the ventral process is depressed the lower profile is an even low arc, broken by an obtuse angle when the process is extended.

The dorsal spine is placed over the posterior third of the eye; it is slightly curved backward at the base, otherwise straight, 1·3 in the length of the head, strong at the base, much weaker above; the front is rounded and without enlarged spines. excepting a few small ones at the apex; it is closely studded with low uniform spinules, as determined with a hand lens, all trending upwards. At each lateral margin is a row of low conical spines directed outward and downwards. The dorsal and anal rays are similar, of medium height; the latter commences under the sixth dorsal ray and terminates slightly behind that fin. The ventral spine is below the space between the dorsal spine and rays, when extended rather nearer the former, when depressed rather nearer the latter; it is fixed and has eight prominent spines, one pair directed forwards, two sideways, and four backwards; of the latter one pair is placed above the other. The pectoral fin is one half longer than the eye, beneath the centre of which its base is inserted. Caudal long and rounded, no short external rays, the pedicel compressed, without either spines or bristles; its height equals the diameter of the eye.

Skin very rough, its texture resembling that of a wire flesh-brush; scales distinct; with from one to four slender curved spines measuring 1·7 mm. in length arising from a bulbous eminence.

Colour.—In spirits uniform greenish-yellow, fins yellow without markings.

It is with some reluctance that I name a *Monacanthus*, especially as many of our species are ill-described. On the whole it seems to be wiser to adopt this course, to supply an adequate description and reliable figure. If more species were figured we should have less synonomy, for, as Dr. P. P. Carpenter said, with the best desire for accuracy and the greatest care, it is hardly possible for an author to so describe that his readers shall see specimens as he sees them.

Monacanthus setosus is most nearly allied to *M. trachylepis*, Günth.,* with which I at first identified it. From this species it differs by having a deeper body, more obtuse snout and larger eye, by the more backward position of the dorsal spine and anterior situation of the gill slit and pectoral fin. The posterior half of the body narrows more obtusely to the caudal pedicel, which is markedly lower, shorter and without spines. In colour it may be distinguished by the absence of blue spots at the base of the fins characteristic of *M. trachylepis*.

It is also allied to *M. rudis*, Rich.,† and *M. convexirostris*, Günth.,‡ but it differs from these species more than it does from *M. trachylepis*.

The single specimen from which the description and figure is made, was obtained off Wollongong in 63-75 fathoms, and is therefore probably an inhabitant of deep water.

MONACANTHUS MOSAICUS, *Ramsay & Ogilby*.

(Plate xvii., fig. 1.)

Monacanthus mosaicus, Rams. & Ogil., Proc. Linn. Soc. N.S.W., xi., 1886, p. 5.

Station 39.

A single example of this rare species was taken by the trawl in 50 fathoms off Wata Mooli, south of Port Jackson. The species was originally described from two specimens measuring four and two-thirds and four inches respectively, obtained off Shark Reef within Port Jackson, in January, 1886. In December of the same year a third was taken in the Parramatta River, which is still smaller. The fourth known example we now chronicle, shows that the species is by no means a small one ; it measures 255 mm. or ten inches in length. The following is a description of the specimen :—

D. 36. A. 34. P. 13. C. 12.

Length of head 3·33, height of body 1·6, length of caudal 3·6, in the total. The eye is one-fourth the length of the head and equal to the interorbital space ; it lies midway between the end

* Günther—Cat. Fish. Brit. Mus., viii., 1870, p. 248.

† Richardson—Voy. Ereb. & Terr., Fish., 1846, p. 65, pl. xl., figs. 7-8.

‡ Günther—*loc. cit.*

of the snout and the dorsal rays, and nearer to the profile by one-half its diameter; the gill opening is oblique, equal to and separated from the eye by a diameter; it is situated beneath the eye, and slightly in advance of the root of the pectoral. Nostrils in a naked groove in front of and near to the eye.

Teeth.—Two pairs in the lower jaw, each produced into an angular point at its inner margin; three projections are thus formed, one median and two lateral. Three pairs in the upper jaw, of which the two inner pairs are pointed; behind this pair, and between which its point appears, is another tooth on each side with a spine-like apex; five projections are thus formed, the inner one, as in the lower jaw, furnished by two teeth.

Upper profile of snout slightly concave, rather tumid in front of the spine, whence it is flat, but rises considerably to the rays. The anterior rays mark the highest point, thence it descends in a gentle curve to the caudal pedicel. The lower profile is a perfect arc described from the margin, one-fourth of the distance of the dorsal rays from the spine, which arises in the anterior third of the eye; it is 1·6 in the length of the head, not very strong, and slightly curved backwards; it is triangular in section, the anterior ridge furnished with two series of small blunt spines set close together; at each posterio-lateral edge is a single series of spines. Soft dorsal and anal low, the rays regularly increasing to the sixth, which with the few following rays is the longest; the anal arises slightly behind the dorsal and terminates nearer the caudal. Ventral spine immovable, very small, with a few points directed before and behind, situated about an eye-diameter from the end of the ventral bone, which is not extensible. Pectoral fin small, one-fifth longer than the eye, placed beneath the orbit. Caudal large and rounded, no shorter external rays, its pedicel compressed, its height one-third the length of the head without spines or bristles.

Skin — Rubbed from head to tail the skin feels quite smooth, and in the reverse direction very slightly rough; under a half-inch objective it is seen to be crowded with simple spines, which measure 0·2 mm. in length.

Colour yellowish, with wavy blue lines for the most part horizontally disposed, anastomising at intervals, and forming hexagonal figures, many of which enclose a brown blotch; fins uniform yellow.

A reference to the type specimens shows that the colour pattern of the young is to a large extent lost in adult examples. I have therefore drawn one of the types of the natural size.

Family OSTRACIIDÆ.

ARACANA, *Gray.*

ARACANA LENTICULARIS, *Richardson.*

BOX FISH.

(Plates xvii. (fig. 2) and xviii.)

Ostracion lenticularis, Rich., Proc. Zool. Soc., ix., 1841, p. 21, and Trans. Zool. Soc., iii., 1849, p. 158.

Stations 1, 2, 4, 8, 9, 10, 11, 12, 18, 21, 22, 23, 24, 26, 27, 32, 33, 50, 52, 54, 59.

The specimens from which Richardson made his description were but half-grown, and as the species undergoes some change during its lifetime further notes may be made.

D. 10. P. 12. A. 10. C. 11.

Adult.—Length of head 3·66, height of body 1·8, length of caudal 5·5 in the total. The eye, set close to the upper profile, 3·3, and the interorbital space, which is flat, 2·0 in the length of the head; the gill opening is very slightly oblique and lies just behind the posterior margin of the eye, the diameter of which its length exceeds by one-fifth: its upper edge is removed from the orbit slightly less than its own length. Nostrils on a prominent papilla in a depression in front of the eye, the anterior much the larger, oval and crenate within, the posterior a small slit.

Teeth long, incisor-like, five pairs in the upper and four pairs in the lower jaw.

Upper profile of snout extremely tumid and acute, the anterior portion nearly vertical. Attaining its most prominent part it slopes backwards and widens rapidly above; at its widest part the dorsal keel commences and rises to form a prominent rounded hump placed in front of the centre of the body; the profile then falls to the end of the carapace, in advance of the dorsal fin, whence it is slightly concave to the caudal. The lower profile forms an even arc described from the summit of the dorsal hump and broken only by the caudal pedicel. The dorsal and anal fins are similar, the second, or longest, ray being slightly more than half the length of the head; the dorsal is the anterior fin. The pectoral is two thirds the length of the head. The caudal is

broadly fan-shaped with the angles rounded, the lower rays longer than the upper.

Carapace much compressed, forming a ridge above and below and two scarcely perceptible ridges, one from behind the eye and the other beneath the pectoral. The carapace terminates in advance of the dorsal fin and passes obliquely backwards on each side by a sinuous line towards the posterior part of the anal; skirting the base of that fin, it passes forward and again unites with its fellow in advance of the anal. The carapace is composed of hexagonal scutes fused together, most apparent on the sides and around and beneath the mouth. From the upper and lower angles of the mouth are two naked lines which unite and form an unprotected area in front of the gill opening and pectoral fin, thus permitting some movement; the lips also are free and fleshy. The whole of the space from before the dorsal and anal to the caudal is naked, with the exception of four bony plates; a large one immediately behind the dorsal fin, widely separated from a similar but smaller plate behind the anal. A third on the upper part of the caudal pedicel in front of the rays which extends to but is not fused with another plate on the lower part; a few isolated patches of armature also occur on the pedicel. All the scutes closely granular, the grains larger than the spaces between them.

Colour.—Uniform greenish-brown.

Young.—Profile of snout straight, interorbital space concave, caused by enlarged supraocular borders, dorsal profile regularly rounded without hump. The dorsal and anal keels are much more compressed than in the adult and all the features of the carapace more pronounced: the lateral ridges are continued, the upper from above the eye to the dorsal fin, and the lower from the angle of the mouth beneath the pectoral to the anal. These ridges are armed with prominent flattened spines arranged as below. One above the posterior angle of the orbit, one a little further behind, another beneath the highest point of the dorsal ridge and a very small one nearer the dorsal fin; there are three or four spines along the lower ridge, of which the first is below the pectoral and the last in advance of the anal. The largest spine of the body occurs on the side midway between the two ridges in the centre of the carapace. The naked groove from the mouth to the gill opening is apparent only as a non-fusion of the scutes and the space around the pectoral, and the mouth is very restricted. The hexagonal plates are most apparent and have large granules forming radiating ridges, the grains widely spaced.

Colour.—Lilac with metallic yellow blotches arranged without reference to the scutes, which are boldly outlined in black. Naked skin slaty-grey. Fins brown, the caudal darker with a lighter margin.

Family TETRAODONTIDÆ.

LAGOCEPHALUS, *Swainson.*

LAGOCEPHALUS LUNARIS, *Bloch & Schneider.*

Tetrodon lunaris, Bloch & Schn., Syst. Ichth., 1801, p. 505. Temm. & Schleg., Fauna Japon., Pisces, 1850, p. 277, pl. cxxii., fig. 1.

Stations 23, 26.

On two occasions we trawled this species off Newcastle in 16 to 32 fathoms, thus adding it to the fauna of New South Wales. Previously it had not been identified southward of Moreton Bay in Queensland.

The two examples are rather small, measuring 210 mm. and 195 mm. respectively. They are to be identified with *T. spadiceus* of Bleeker, characterised by the interorbital space and fore part of the back being covered with spines, and the length of the head less than its distance from the dorsal fin. Castlenau, identifying an example in the Queensland Museum taken in Moreton Bay, remarks* :—"the length of the head is more considerable than is said in Dr. Günther's description; this fish certainly belongs to Richardson's *spadiceus* from the Chinese and Indian Seas, and may be different to the typical *lunaris*."

AMBLYRHYNCHOTUS, *Bibron.*

AMBLYRHYNCHOTUS OBLONGUS, *Bloch.*

Tetrodon oblongus, Bloch., Ausl. Fisch., 1787, p. 4, pl. cxlvi., fig. 1.
Tetraodon oblongus, Bleek, Atlas Ichth., Gymnod, v., 1865, p. 62, pl. iv., fig. 4.

Stations 23, 51.

Examples were taken on the sandy flats of the Newcastle and Shoalhaven Bights in 15-19 fathoms. The species had been previously recognised in Australian waters only from King George's Sound, and is therefore for the first time recorded for the east coast.

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* Castelnau—Proc. Linn. Soc. N.S.W., iii., 1879, p. 401.

Family DIODONTIDÆ.

DICOTYLICHTHYS, *Kaup.*

DICOTYLICHTHYS PUNCTULATUS, *Kaup.*

PORCUPINE FISH.

(Plate xix.)

Dicotylichthys punctulatus, Kaup., Arch. für Nat., 1855, p. 230.

Station 23.

This is a very common form on our coast, and is frequently included in hauls made by the fishermen on the beaches; it is also often thrown up dead. When the flesh has rotted out the tough dry skin holds the spines firmly, and the light object is trundled about by the wind and buried in the sand hills. The largest specimen I have seen measured seventeen inches in length. One living example only was obtained by the "Thetis"; it was taken in Newcastle Bight in 16-19 fathoms.

CHILOMYCTERUS, *Bibron.*

CHILOMYCTERUS JACULIFERUS, *Cuvier.*

JAVELIN FISH.

Diodon jaculiferus, Cuv., Mém. Mus. Hist. Nat., iv., 1818, p. 130, pl. 7.
Chilomycterus jaculifera, Günth., Cat. Fish. Brit. Mus., viii., 1870, p. 313.

Station 17.

Günther has identified this species from New Zealand, and Castelnau* from Victoria (Hobson's Bay). The single specimen here recorded was taken off Broughton Island, north of Port Stephens, in 29-48 fathoms, and measures 230 mm. (= 9 inches) in length. The peculiarity of the species, emphasised in the name, is the presence of long javelin-like spines. Of two examples in the British Museum, Günther writes:—"One is distinguished by the extraordinary length of certain spines (supraorbital, dorsal, post dorsal, and post pectoral), as noticed by Cuvier. In the other example these spines are but slightly enlarged, and, in fact,

* Castelnau—Proc. Zool. Soc. Vict., i., 1872, p. 211.

all the spines are rather feeble." I do not find that Cuvier noticed long spines either above the orbit or on the back; he wrote of those behind the pectoral and on the flanks. In the "Thetis" specimen the only spines which are strikingly enlarged are a pair behind the root of each pectoral and another on the caudal pedicel. So subequal are the dorsal spines that no particular one can be selected as that referred to. While all other spines are immovable, the post pectoral is capable of some degree of erection; when adpressed the pectoral fails to conceal the point of the spine, but it does not in any way approach the development illustrated by Cuvier. All other spines are very short, and nowhere does the tip of one reach to the base of that behind it, so that no overlapping occurs.

Castelnau's specimen was imperfect, and he described the anal fin as being much smaller than the dorsal: this is incorrect, and the complete radial formula is as follows:—

D. 16. A. 15. P. 20. C. 8.

Colour dark brown above, each spine on the body set in an ill-defined black blotch; underneath parts white without spots; from the dark dorsal portion and passing into the white beneath are three black vertical bars, one in front and another behind the pectoral, and a third below the origin of the dorsal. No darker mark below the eye.

Cuvier's figure, although indicating the peculiarities of the species, is somewhat crude; yet as our example is perhaps scarcely typical, I hesitate to illustrate it.

Family SCORPÆNIDÆ.

SCORPÆNA (*Artedi*), *Linnæus.*

SCORPÆNA CRUENTA (*Solander*), *Richardson.*

RED ROCK-COD.

Scorpæna cruenta, Rich., Ann. Mag. Nat. Hist., (1), ix., 1842, p. 217.

Scorpæna militaris, Rich., Voy. Ereb. & Terr., Fish., 1846, p. 22, pl. xiv., figs. 1, 2.

Station 55.

The only occasion on which this fish was netted, the trawl encountered rock, and brought up two large basalt boulders, from which a wealth of invertebrate life was taken. Wherever lines were put over on the various Schnapper-grounds, the species was taken, its capacious mouth receiving the largest bait.

SEBASTAPISTES (*Gill MS.*), *Streets.*

SEBASTAPISTES PERCOIDES (*Solander*), *Richardson.*

RED GURNARD PERCH.

Sebastes percoides, Rich., Voy. Ereb. & Terr., Fish., 1846, p. 23, pl. xv., figs. 1, 2.

Stations 7, 13, 25, 42, 44, 48, 56.

This species is rather uncommon in our markets, and those obtained at the above named stations were for the most part half-grown specimens. Most of the areas on which they were taken were sandy; this would indicate that the species is not so wedded to rocky situations as has been imagined. It was only gleaned in deep water, the least depth being 41 and the greatest 80 fathoms. Although lines were put down on many of the recognised Schnapper-reefs, it was never hooked.

SEBASTES, *Cuvier & Valenciennes.*

SEBASTES THETIDIS, sp. nov.

THETIS FISH.

(Plate xx.)

Stations 7, 42, 48, 49.

B. vii. D. xii. 1/9. A. iii. 5. V. i. 5. P. 13·7. C. 14. L. lat. 38. L. tr. 5·32.

Length of head 2·18, height of body 2·45 in the total length (caudal excluded).

Diameter of eye 3·33, length of snout 3·8, and interorbital space, deeply concave, 4·4 in the length of the head.

Nostrils separated, in a naked area, the anterior surrounded by a low fleshy rim with a tentacle behind; posterior nostril simple. Upper jaw in front, concave, a tubercle at the symphysis of the lower jaw. Cleft of mouth wide and rather oblique, the maxilla reaching to below the posterior fourth of the orbit. The internasal space is concave and is surmounted on each side, near the anterior nostril, by a simple spine. At the antero-superio angle of the eye is a spine which may be simple, bifurcate or trifurcate; further back towards the posterior angle, are three or four irregular spines, all, however, arising from a common base. On the occiput, mid

way between the last named spines and the dorsal, is a pair of flattened spines, converging anteriorly. On the posterior rim of the eye is another trifurcated spine succeeded on the temporal by a jagged flattened series, and in the same line another immediately at the origin of the lateral line. Two opercular spines, the upper simple, on the superior edge; the lower longer and provided half way between its point and the eye by a supplemental spine, connected by a prominent ridge which may also be spinous. A row of jagged spines runs from the preorbital horizontally to a point in advance of, and above the upper preopercular spine, and gives off two downwardly directed spines over the centre of the maxilla.

Preopercle armed with four spines, the upper the largest and reinforced like the lower opercular; the next two are rather jagged, while the lower is simple and obtuse. A large flattened spine on the clavicle, above the origin of the pectoral. Lateral line unarmed, excepting quite anteriorly, where feeble spines are developed.

Teeth cardiform in the jaws, in a triangular band on the vomer, and in bands on the palatines curved anteriorly.

The dorsal commences above the inner angle of the opercle; the fourth spine is the longest, twice the diameter of the eye and much longer than the longest ray; the twelfth spine is two-thirds the length of the thirteenth, which is equal to the first. The base of the spinous portion is more than three times that of the soft, which is not attached to the tail.

The anal commences beneath the twelfth dorsal spine; the second spine is the longest, 1·7 in the fourth and equal to the ninth dorsal spine, or one-third in the length of the head; the third anal is not much shorter than the second. The rays are equal to those of the dorsal.

The ventral does not reach the vent, its length being 1·57 in that of the head; the spine is very strong and equal to the second dorsal; it originates quite close to the lower pectoral ray.

The pectoral is a trifle longer than the ventral and reaches to the vent; the six or seven lower rays are simple. The caudal is gently rounded, the least height of its pedicel being 3·4 in that of the body.

The lateral line at its highest point is concealed by the opercular flap.

Scales.—Entire head, including the snout and maxilla, covered with ciliated scales, each with a central depression, and the margin conspicuously raised so as to give the head a very scabrous appearance. The mandible is scaleless and the inferior margin has four equidistant pairs of large muciferous pores. The scales on the body are larger, deeper and less raised, those on the throat and at the base of the pectoral, much smaller.

Colours.—General colour (in spirits) yellowish-brown, the lower parts reddish-yellow, mandibular, isthmus and branchiostegals pink. The markings are in the form of black blotches, which, judging from our specimens, are very constant in position and extent. Along the dorsal profile are three spots, the first below the 5-7 and the second at the base of the 8-10 spines; the third spot is smaller and situated beneath the 2-4 rays. The opercle is bordered behind by a large blotch which reaches to below the eighth spine; this is succeeded by two spots, of which the anterior is the lower. Another extensive blotch occurs beneath the dorsal rays: all these show bright blue reflections. On the head the dark markings are to be found between the eyes on the occiput, the temporal bone and behind the eye. Fins yellowish, the pectoral with a smoke-coloured blotch near its margin, and the dorsal membrane dark at its edge.

Four examples were obtained, of which the largest measures 305 mm. (=12 inches) in total length.

The species was taken in comparatively deep water, namely, from 55 to 78 fathoms, off the coast between Port Jackson and Port Kembla.

The genus *Sebastes* has been considerably subdivided, principally as affecting American species. I have, however, so far, been unable to identify *S. thetidis* with any of the genera characterised, and therefore, for the present, merely leave the species in *Sebastes*, as originally understood.

NEOSEBASTES, *Guichenot.*

NEOSEBASTES ROBUSTUS, *Günther.*

Bullrout.

Centropogon robustus, Günth., Cat. Fish. Brit. Mus., ii., 1860, p. 128.
Centropogon trochelii, Steind., Sitz. K. Akad. Wiss. Wien., liii., 1866, p. 440, pl. iv., fig. 1.

Station 51.

The fact of our having trawled this species in Shoalhaven Bight extends the known distribution in a southerly direction; its range, therefore, as far as is known, is from this station to the Mary River, Queensland, where it was obtained by the "Chal-

lenger" expedition. The Bullrout is what may be termed a fluvio-marine species, ranging from the sea through brackish waters to the rivers above tidal influence. Respecting the painful wound caused by the dorsal and preorbital spines of this species the author of the "Edible Fishes of New South Wales" (p. 68) writes :—"No doubt any such wound would cause pain, but the state of the sufferer's health, his nervousness, and his belief in the superstition of its poisonous qualities are all factors which must be taken into consideration. Personally the writer has been 'stung' on many occasions, both by the allied Fortescue *(Centropogon australis)* and by the British Weaver *(Trachinus vipera)* and never felt any more inconvenience than would result from a similar stab of a knife. The fact is the wound is merely a deeply punctured and viciously inflicted one, without any venomous properties whatever."

I also, on more than one occasion, have been stung by both the Australian and British species mentioned, and, without being either nervous or superstitious, my experience is that such wounds are painful in the extreme. Further, I cannot agree with this writer as to the absence of venomous properties. Although the spines are not perforated they are deeply grooved, and the grooves are charged with a fluid-mucous possessing poisonous properties, the truth of which is sufficiently apparent to the majority of persons who have the misfortune to be stung.

The largest example I have met with measures 265 mm. in length.

NEOSEBASTES AUSTRALIS, *White.*

FORTESCUE.

(Plate xxi.)

Cottus australis, White, Voy. to New South Wales, 1790, p. 266.
Centropogon australis, Günth., Cat. Fish. Brit. Mus., ii., 1860, p. 128.

Station 23.

Two examples were obtained in Newcastle Bight at the somewhat unusual depth of 16-19 fathoms, the species being better known in shallow water cruising around the piles of piers and jetties, where it is much dreaded by the wharf-fishers for the painful wounds it inflicts with the dorsal and, more especially, the preorbital spines.

Family COTTIDÆ.

PLATYCEPHALUS, *Bloch & Schneider.*

PLATYCEPHALUS FUSCUS, *Cuvier & Valenciennes.*

FLATHEAD.

Platycephalus fuscus, Cuv. & Val., Hist. Nat. Poiss., iv., 1829, p. 241. Quoy. & Gaim, Voy. de l'Astrolabe, Poiss., 1835, p. 68, pl. x., fig. 1.

Stations 1, 2, 4, 5, 7, 8, 9, 10, 11, 12, 13, 20, 21, 22, 23, 24, 25, 26, 27, 28, 32, 33, 34, 35, 37, 38, 39, 41, 42, 43, 44, 46, 48, 49, 50, 51, 52, 54, 55, 56, 58, 59.

The array of stations at which this species was obtained indicates how common it is on our seaboard. It is plentiful in our rivers a long way above tidal influence; it occurs on all the mud banks and sand flats along the coast, and is found at considerable depths also. We trawled it in 78, 80 and 84 fathoms. As the trawling took place during the known spawning season of this fish, it was not surprising to find many of the examples heavy with ova, while not a few small fry were trawled, indicating that breeding had already taken place. The largest example I have seen measured 920 mm. ($=36\frac{1}{4}$ inches) in length.

PLATYCEPHALUS BASSENSIS, *Cuvier & Valenciennes.*

BASS FLATHEAD.

Platycephalus bassensis, Cuv. & Val., Hist. Nat. Poiss., iv., 1829, p. 247. Quoy. & Gaim., Voy. de l'Astrolabe, Poiss., 1835, p. 683, pl. x., fig. 3.

Stations 8, 9, 13, 39, 44.

It was only at the above mentioned stations that I definitely recognised this species, but it is more than probable that some were overlooked. When the quarter-deck of the vessel was simply one mass of fish, it was quite impossible for me to personally examine every specimen of *Platycephalus* or *Lepidotrigla* which were sometimes piled on the deck by thousands. *P. bassensis*, although not so common as *P. fuscus*, is yet very plentiful in the Sydney Fish Market.

Family TRIGLIDÆ.

LEPIDOTRIGLA, *Günther.*

Three species of the genus were obtained, one of which proves to be new. I regret that I am unable to supply the stations exactly for each species. It was quite impossible for me, working as I was, unaided, to pass under hand every specimen obtained. I can, therefore, only give a general list of the stations whence members of the genus were taken, together with one or two exact references where notes were made.

As the net neared the surface large numbers of dead Gurnards rose to the top and floated belly upwards, with their pectoral fins extended; they were taken at almost every haul, sometimes in extremely large numbers, forming an immense heap on the deck. They were also taken in the tangles (fig. 7), their spiny armaments rendering them particularly liable to be so caught.

The list of stations is as follows:—

Stations 1, 2, 4, 5, 7, 8, 9, 10, 11, 12, 13, 22, 24, 25, 26, 27, 28, 32, 34, 35, 37, 38, 39, 40, 41, 43, 44, 46, 47, 48, 49, 51, 52, 56, 57, 58, 59.

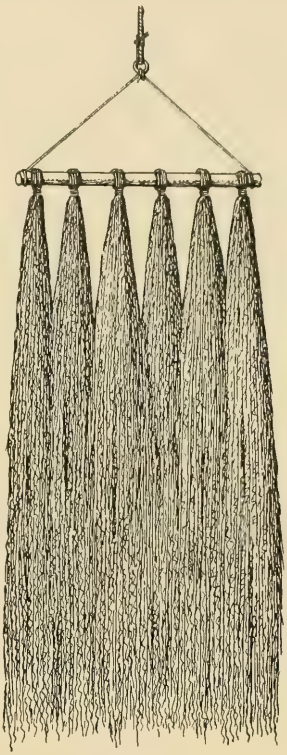

Fig. 7.

LEPIDOTRIGLA MULHALLI, *Macleay.*

(Plate xxii.)

Lepidotrigla mulhalli, Macl., Proc. Linn. Soc. N.S.W., viii., 1884, p. 460.

Stations 13, 46; also see note above.

Macleay described this species as being abundant in 40 fathoms of water outside Port Jackson Heads. We found it to extend

all along the coast within the area worked and common at the greatest depths tested. The original description being rather short, a more detailed account is now furnished and a figure supplied.

B. vii. D. ix. 14. A. 14. P. 11. 3. V. i. 5. L. lat. 60. L. tr. 3/16.

Length of head 3·26, height of body 4·28 in total length (caudal excluded). Diameter of eye 2·87, length of snout 2·3 in the length of the head, interorbital space, which is slightly concave, three-fourths the diameter of the eye. The whole profile of the head is markedly convex, that of the nasal region approaching the perpendicular. Two spines at the antero-superio angle of the orbit, a long protuberance at the posterior angle. Preorbital greatly produced, bearing two or three very strong spines and a number of smaller ones. Angle of preoperculum jagged, without distinct spines. Opercle with two obtuse spines. Clavicular spine very strong, finely toothed on its basal half, supra-scapula spine moderately strong. The maxilla reaches the anterior third of the eye. The first two dorsal spines are weakly serrated in front, the third is the longest, 1·6 in the length of the head. The anal commences and terminates evenly with the soft dorsal, to which it is therefore equal in extent. The pectoral, which is longer than the head by one-seventh, reaches the sixth anal ray. The ventral equals the head in length and extends to the fourth ray. Caudal emarginate. The armoured area surrounding the dorsal fin is composed of twenty-two scales, all are strongly spined; a constriction takes place in front of the rayed portion, the following paired spines being separated by only half the distance between those of the anterior spinous portion.

Scales smooth, the spines of the lateral line are weak and consist of a median series only.

Colours.—Brilliant red throughout when alive, dirty brown in spirits; pectoral black within.

Total length 197 mm.

LEPIDOTRIGLA MODESTA, sp. nov.

(Plate xxiii.)

Stations 17, 46; also see note above.

This new species appears to be associated with *L. mulhalli*, but may be less common. It would seem to be more plentiful to the northward, and I did not definitely recognise it south of Botany

Bay (Station 46), while off Broughton Island (Station 17) it was plentiful in 66 fathoms.

B. vii. D. ix. 16. A. 16. P. 9·3. V. i. 5. L. lat. 60.
L. tr. 4/12.

Length of head 3·35, height of body 4·4 in total length (caudal excluded). Diameter of eye, which equals the length of the snout, 2·87 in that of the head Interorbital space extremely concave, V-shaped, three-fourths the diameter of the eye; superciliary ridges very large. Nasal profile very steep and slightly concave. Two spines at the antero-superio angle of the orbit, which is laterally concave, culminating in a bony protuberance on the upper posterior angle; preorbital produced and emarginate, bearing anteriorly several strong spines. Preoperculum with two or three small points. Two opercular spines, the lower the larger. Apart from the fins the largest spine occurs on the clavicle; the ridge of the spine is strongly serrated almost to its apex. The serrations of the supra-scapula lead up to a single spine. A groove between the ocular and occipital regions. The maxilla only just reaches as far as the margin of the orbit. The two first dorsal spines are serrated anteriorly; the second is the longest, 1·6 in the length of the head. The anal commences beneath the second dorsal ray and extends rather further back than the dorsal. The pectorals and ventrals both reach the first anal; they are of equal length, exactly that of the head. Caudal slightly emarginate. The armoured area surrounding the dorsal is composed of twenty-four scales, the anterior three or four rugose, the remainder strongly spined. The median spines of the lateral line are not very strong and do not project beyond the free margin; in parts this spine is doubled, the additional point being directed upwards.

Colours.—Bright red when first obtained. In spirits a uniform yellowish-brown. Pectoral dark within; all other fins immaculate; no trace of a spot on the dorsal.

All the scales with the exception of those bordering the dorsal and those of the lateral line have been lost: the pits have therefore been counted for the transverse series above given. Total length 188 mm.

LEPIDOTRIGLA PLEURACANTHICA, *Richardson.*

Trigla pleuracanthica, Rich., Voy. Ereb. & Terr., Fish., 1846, p. 23, pl. xvi., figs. 1-4.
Lepidotrigla pleuracanthica, Rams. & Ogil., Proc. Linn. Soc. N.S.W., x., 1886, p. 578.

Station 52; also see note above.

The only specimen recognised was trawled in 20 fathoms off Shoalhaven Bight. Although a scarce species on our coast, it is

more than probable that examples were elsewhere overlooked for reasons given in the above note. I have since taken another specimen in Jervis Bay.

CHELIDONICHTHYS, *Kaup.*

CHELIDONICHTHYS KUMU, *Lesson & Garnot.*

RED GURNARD.

Trigla kumu, Less. & Garn., Voy. Coquille, Poiss., 1826, pl. xix.
Chelidonichthys kumu, Jord. & Everm., Report U.S. Com. Fish. for 1895 (1896), p. 488, footnote.

Stations 1, 2, 5, 10, 11, 12, 13, 17, 21, 26, 31, 33, 38, 39, 40, 41, 46, 47, 52, 54, 58, 59.

A glance at the above figures might give one the idea that the species is plentiful on the coast; this, however, would be scarcely correct, for although taken on twenty-two occasions, not more than five or six were averaged at each take, while some of the stations are represented each by a single individual.

Several examples of three or four inches in length obtained would indicate that the spawning season is about November or December, as deduced by Ogilby.* The largest example I measured was 580 mm. ($22\frac{3}{4}$ inches) in length.

PTERYGOTRIGLA, gen. nom. nov.

This name is proposed in lieu of *Hoplonotus* for *Trigla polyommata*, Rich. In 1866 Guichenot made this species the type of a new genus, using the name *Hoplonotus:* this name is untenable, having been, in 1851, applied by Blanchard to a genus of Coleoptera.

PTERYGOTRIGLA POLYOMMATA, *Richardson.*

"FLYING" GURNARD.

Trigla polyommata, Rich., Proc. Zool. Soc., 1839, p. 96, and Trans. Zool. Soc., iii., 1849, p. 87, pl. v., fig. 2.
Hoplonotus polyommatus, Guich., Ann. Soc. Linn, Maine-et-Loire, Ichth., ix., 1866 (*fide* Zool. Rec. 1866, p. 146.)

Stations 1, 11, 38, 40, 41, 43, 46, 56, 57.

This species was taken less commonly than the last, but all the specimens were of large size, smaller ones being almost unknown

* Ogilby—Edible Fishes, N.S.W., 1893, p. 110.

so far north. The Port Stephens district is regarded as its most northern range; and in confirmation of this it is to be noticed that it was never obtained north of Tuggerah Lakes, and only twice north of Port Jackson.

Family TRACHINIDÆ.

SILLAGO, *Cuvier.*

SILLAGO MACULATA, *Quoy & Gaimard.*

TRUMPETER WHITING.

Sillago maculata, Quoy & Gaim., Voy. Freycinet, Zool., 1824, p. 261, pl. liii., fig. 2.

Stations 1, 2, 4, 8, 9, 13, 17, 20, 21, 22, 23, 24, 25, 26, 27, 33, 38, 39, 43, 50, 51, 52, 58.

Great confusion has existed in the determination of our two common species of *Sillago*, namely, *S. maculata* and *S. ciliata*, and it has been stated that, except in the matter of spawning, they do not differ materially in habit. Such a statement is by no means borne out by our experience.

S. maculata was trawled on no less than twenty-three occasions throughout almost the whole area traversed, namely, from the Shoalhaven to the Manning River, and at all depths ranging from 16 to 84 fathoms. *S. ciliata* was never once taken. My experience indicates that, of the two, it is only this latter species that is caught by hook and line off the ocean beaches or bays, while, as seems probable, the former is more partial to deep water, and would probably be the fish taken by the trawl. *S. ciliata* is said to spawn along the sand banks of the bays and rivers, otherwise in shallow water. Many examples of *S. maculata* were taken heavy in spawn, while some had apparently just shed their ova.

Family PERCOPHIDÆ.

PARAPERCIS, *Gill.*

PARAPERCIS OCULARIS, sp.nov.

(Plate xxiv.)

Stations 4, 5, 6, 13, 21, 42, 43, 46, 47, 56.

B. vi. D. v. 21. A. 18. V. i. 5. P. 19. L. lat. 62. L. tr. 4·17.

Length of head 3·8, of caudal fin 4·8, height of body 4·7, in the total length. Eye very large, 2·6 in the length of the head,

rather more than the length of the snout, and thrice the interorbital space. The greatest width of the head is greater than the length of the eye and snout together. Snout rather acute. Cleft of mouth slightly oblique; lower jaw a little the longer; the maxillary reaches to just within the anterior margin of the eye. The hind limb of the preoperculum is tuberculate rather than serrated. One flat opercular spine.

Teeth.—A broad band of villiform teeth in each jaw, the outer row the larger; four pairs of canines at the symphysis of both jaws, and similar teeth on the lateral edges; a large patch of teeth on the vomer; palatines toothless. Dorsal spines subequal, one-third the length of the head, the first two originating close together. Rays long, 1·6 in the same. The pectoral is contained 1·2 in the length of the head, and is longer than the ventral, which latter reaches the anal. The anal is lower than the soft dorsal. Caudal truncate, its pedicel one-third the length of the head.

Scales ciliate, rather large, rather adherent, those of the lateral line anteriorly with the tubule ascending.

Colours.—Warm brown above, each scale with a lighter centre; white beneath, with an ill-defined yellowish band separating the areas; head greyer and darker than the body; seven large dark brown blotches at the base of the dorsal, extending below the lateral line anteriorly; a dark band at the base of the caudal rays, forming a blotch at the upper and lower margins; tail crossed by five vertical yellow bands; no blotch in the spinous dorsal; its margin, as also that of the rays, ornamented with white spots; rest of fins yellow.

Total length 190 mm.

The species of this genus have been so ill-described that one naturally hesitates to bestow additional names. On the other hand, without reference to the actual type, it is absolutely impossible to decide how far any description may be applied to an individual.

As far as may be judged, therefore, the present form is undescribed, and I consider the wiser course is to publish the foregoing description and accompanying figure for the consideration of those who may be in a position to solve the problems involved.

The most striking features of the species are the very large size of the eye and the small width of the interorbital space. These characters, together with the subequal length of the dorsal spines, render it a very striking and peculiar species. As I have examined all other specimens available to me, some observations made thereon may be fittingly published.

When Ogilby described *Percis novæ-cambriæ*,* he considered that this was the species upon which *P. nebulosus*, Q. & G., had been assigned to the Australian fauna, and in his catalogue† he wrote under *P. novæ-cambriæ*:—"This species has been confounded by Australian naturalists with the *Percis nebulosus* of Quoy and Gaimard, from which, however, it is very distinct."

It is to be remarked, however, that the identification of Australian specimens rested with Quoy and Gaimard, and I now propose to support their action. In the Museum Collection is a specimen labelled *P. nebulosus*. This is certainly not *P. novæ-cambriæ*, and agrees so well with the description of the first named species that I have thereto assigned it. From this specimen the type of *P. coxi*‡ does not differ. It is a faded example of *P. nebulosus*, and was obtained in Port Jackson.

The following species are now to be regarded as belonging to the fauna of New South Wales:—

Parapercis nebulosus, Quoy & Gaim. (? *P. maculata*, Bl. Schn.).

P. allporti, Günth. (Twofold Bay).

P. novæ-cambriæ, Ogil.

P. ocularis, Waite.

Parapercis ocularis is apparently a denisen of deeper water. It was very sparingly taken about 30 fathoms, but abundantly so in the deepest areas tried, namely, 80 to 84 fathoms. The large size of the eye is in accord with the ascertained vertical range.

CENTROPERCIS, *Ogilby.*

CENTROPERCIS NUDIVITTIS, *Ogilby.*

(Plate xi., fig. 2.)

Centropercis nudivittis, Ogil., Proc. Linn. Soc. N.S.W., (2), 1895, x., p. 320.

Station 46.

The example obtained is but the second known and was taken eight miles south of Maroubra Bay, where the type was collected. It is much larger than the type, measuring 103 mm. in length, and advantage is taken to slightly amend the original description.

The number of tubular scales on the lateral line is twenty-seven, and not eighteen merely, as stated; the naked bands along

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* Ogilby—Proc. Linn. Soc. N.S.W., (2), x., 1896, p. 228.

† Ogilby—Cat. Fishes, N.S.W., 1886, p. 30.

‡ Ramsay—Proc. Linn. Soc. N.S.W., viii., 1883, p. 179.

the abdominal surface are alternate to those above, and from the throat to the vent is a broad silvery space in which the ventrals are inserted.

The type specimen was washed ashore at Maroubra Bay in a perfect though dying condition. Our example was taken in the trawl from a depth of 50-66 fathoms, when mud and abattoir refuse was brought to the surface.

Family URANOSCOPIDÆ.

ICHTHYSCOPUS, *Swainson.*

ICHTHYSCOPUS INERMIS, *Cuvier & Valenciennes.*

STARGAZER.

Uranoscopus inermis, Cuv. & Val., Hist. Nat. Poiss., iii., 1829, p. 310, pl. lxv. Temm. & Schleg., Fauna Japon., Pisces, 1850, p. 27, pl. x. A.

Ichthyscopus inermis, Day, Fishes of India, 1878, p. 261, pl. lv., fig. 5.

Stations 8, 10, 23, 26, 28, 33, 49.

Although without doubt of this species the specimens differ from those previously described in minor particulars, all the supports of the dorsal fin, with the exception of the first two, are articulated as determined by means of a hand lens; the first four are simple, the remainder divided.

White round or oval spots on the body and fins are entirely absent, the ornamentation taking the form of three broad bands, one on the soft part of the preopercle, the second behind the operculum embracing the four anterior dorsal rays and the whole of the pectoral, and the third below the 12-17 dorsal rays; none of these bands reach the ventral surface. The example below referred to as from Newcastle exhibits these bands very distinctly, but it is noteworthy that the white markings are also present.

It is now first recorded from Australian waters, but an example was obtained by Mr. Whitelegge at Newcastle some years ago, off which port we secured the greater number; once only, and then a single specimen, was it taken south of Port Jackson (Station 49), but it is rather remarkable that it was there trawled at the depth of 63-75 fathoms. At none of the other stations was a greater depth than 28 fathoms recorded. A large example, measuring 25 inches in length, contained a *Sillago ciliata*, 14 inches long: the capture of such a lively fish indicates how admirably the sluggish *Ichthyscopus* must assimilate its surroundings.

KATHETOSTOMA, *Günther.*

KATHETOSTOMA LÆVE, *Bloch. & Schneider.*

STONE LIFTER.

Uranoscopus lævis, Bloch. & Schn., Syst. Ichth., 1801, p. 47, pl. viii.
Cuv. & Val., Nat. Hist. Poiss., iii., 1829, p. 319.

Stations 9, 13, 42, 43.

Although occasionally taken in Port Jackson, whence I have seen two or three examples, this species does not appear to have been previously recorded from the colony. Günther* gives Port Arthur (Tasmania) as a definite locality, while Castelnau† describes it as being rather common on the Melbourne Market.

It was not obtained far, either north or south of Port Jackson, but was taken at the unexpected depth of 78 fathoms, the minimum being 28. All the examples were small, none being more than 6 inches in length.

The fact of the trawl having freely secured fishes of such burrowing habits as the *Uranoscopidæ* indicates how closely it must have swept the ocean floor.

Family BLENNIIDÆ.

CRISTICEPS, *Cuvier & Valenciennes.*

CRISTICEPS ARGYROPLEURA, *Kner.*

(Plate xi., fig. 3.)

Cristiceps argyropleura, Kner, Reise Novara, Fische, 1869, p. 199, tab. vii., fig. 4.

Station 46.

The single example obtained is assigned to this species, but the Australian members of the genus much require revision. As our specimen does not wholly agree with Kner's account, the following description is furnished:—

B. vi. D. iii./34. A. 24. V. 3. P. 11. C. 11. L. lat 49.

The height of the body, the first dorsal spine, the pectoral and the caudal each equal the length of the head, which is 4·4 in that of the body, caudal excluded. The diameter of the eye is contained five times in the length of the head; the snout is a third less than the diameter of the eye, and is equalled by the inter-

* Günther—Cat. Fishes Brit. Mus., ii., 1860, p. 231.

† Castelnau—Proc. Zool. Soc. Vict., i., 1872, p. 91.

orbital space; a simple tentacle over the eye and a digitate one on the snout. The first dorsal, which arises over the orbit, is attached to the second at the base; the second dorsal commences low, little more than a third the height of the first spine, but increasing in height; the thirtieth ray is twice that of the first.

The anal is much lower than the dorsal, longer posteriorly, and terminates at the origin of the caudal pedicel; the dorsal, on the other hand, being attached thereto by a membrane, which however does not reach the caudal rays. The pectoral attains to the fourth anal ray. The ventral just fails to reach the vent; its rays are free for one-third their length. The caudal pedicel is long and slender, its least height equal to the length of the snout; the fin is lanceolate in shape. The lateral line arises in advance of the opercular flap, over which it forms an obtuse angle; the first thirty-three pores are crowded together, thence it suddenly drops to the mid line of the body, where the pores are separated, widely so, as the caudal is approached. The fish is scaleless, and the muscle bands are very pronounced.

Preserved in formaline the colour is uniform pale orange; the vertical fins are clouded, with the exception of their lengthened posterior margins, which are clear.

Total length 80 mm.

The specimen was secured between Cape Hawke and Charlotte Head in 10-12 fathoms.

The type of *C. argyropleura* was sent from Sydney. It measures but two inches in length, or less than two-thirds the length of ours. The figure quoted represents our example tolerably, but the caudal rays are represented (if one may so say) of subequal length. It has therefore been thought advisable to figure the larger example.

Family GNATHANACANTHIDÆ.

HISTIOPTERUS, *Temminck & Schlegel.*

HISTIOPTERUS ELEVATUS, *Ramsay & Ogilby.*

(Plate xxvi.)

Histiopterus elevatus, Rams. & Ogil., Proc. Linn. Soc. N.S.W., (2), iii., 1888, p. 1311.

Stations 5, 7, 15, 22, 34, 38, 42, 44, 47, 48, 56, 57.

This species was established on a single and imperfect specimen, and was afterwards considered by one of the authors (Ogilby)*

* Ogilby—Edible Fishes, N.S.W., 1886, p. 31.

to be identical with *H. typus*, Schlegel, from Japan. Originally, the authors wrote:—"But for the difference in the number of the dorsal spines and some other minor variations, I should have been inclined to consider this to be the species described in the 'Fauna Japonica' as *H. acutirostris*."

A reference to the descriptions of Schlegel's species shows that *H. elevatus* is quite distinct, and further suggests that *H. acutirostris* is merely a young form of *H. typus*.

From an examination of the good series of *H. elevatus* obtained by the expedition, I am able to supplement and amend the original description as below:—

B. vi. D. v. i. 26-28. A. iii. 14. V. I. 5. P. 14. C. 17.
L. lat. 66-68. L. tr. 14-43.

Length of head 2·54, height of body 1·6 in the length (caudal excluded). Diameter of the eye 3, length of the snout 2, and the interorbital space 4, in the length of the head.

The snout above is markedly concave, the occiput less so, and bounded above by a very prominent bony boss. The interorbital area is convex, marked by a deep median groove. Above the bony boss the profile rises by a gentle convex curve to the third or fourth dorsal ray, which marks the highest point of the body, thence it suddenly descends to the caudal pedicel. The lower profile from the snout to the first anal ray is almost straight, thence, corresponding to the dorsal, it abruptly gains the caudal pedicel.

Lower jaw the longer; cleft of mouth slightly oblique; the maxilla extends nearly to below the anterior nostril, the width of its distal extremity less than five in the diameter of the eye. The serrations of the preopercle and post temporal are weak, less so at the angle of the former.

Teeth.—Both jaws are furnished with small conical teeth, set in a very broad band in front, much narrower at the sides. Vomer, palatines and tongue edentulous.

In the original description the dorsal fin formula is rendered as vii. 24, but a recount of the spines of the type, and a comparison with perfect examples, shows that this is an error, the first ray having been mistaken for and counted as a spine, although noticed as a slender one.

The first dorsal spine is very small, and the rest regularly increase to the sixth, which is the longest, slightly shorter than the head, being 1·1 therein. The relative length of the spines is 1, 4, 7, 11, 17. The first two rays are produced, nearly equal, as long as the head and body, or two and a half times

the length of the longest spine; regular but rapid diminution takes place, so that the seventh ray is no longer than the last spine; the last ray equals the second spine in length. The first anal spine is small, equal to the second dorsal; the second is the longest, and by far the strongest, intermediate in length between the fourth and fifth dorsal, and 2·2 in the length of the head.

The soft anal is similar to the hinder part of the dorsal; none of the rays are elongate, and the first is about two-thirds the length of the head.

The ventral spine is somewhat shorter, but much stronger than the last dorsal; the three anterior rays are nearly as long as the head and reach the origin of the anal rays, and the pectoral, which is of similar length, attains the same point. The caudal lobes are equal, the tail is slightly emarginate, and the height of the pedicel is 2·6 in the length of the head. The thickest part of the fish is immediately behind the orbit; this does not exceed 2·5 in the length of the head.

Scales cycloid, of moderate size; scales on the cheeks, and on a small patch above and another behind the eye; also a somewhat larger one on the upper part of the opercle; other portions of the head sculptured, chiefly in lines radiating from a centre. The lateral line rises abruptly from the opercle, and when beneath the fifth or sixth dorsal spines assumes the curvature of the profile to beneath the last ray, whence it passes horizontally to the base of the caudal rays.

Colour.—The general colour is silvery-grey, with three indistinct vertical bands, the first including the frontal boss, the second embracing the centre of the body, and the third passing obliquely from the posterior dorsal rays, crossing the base of the caudal peduncle, and terminating behind the anal. None of the spines are coloured; a black blotch occurs between the twelfth and eighteenth dorsal rays, and the membranes of the ventrals are black.

HISTIOPTERUS FARNELLI, *Waite.*

(Plate xxvii.)

Histiopterus farnelli, Waite, "Thetis" Prelim. Report, 1898, p. 33, pl. iv.

Station 50.

B. vi. D. vii. 17. A. ii. 10. V. i. 5. P. 17. C. 17.
L. lat. 135.

Length of head 2·85, height of body 2 in the length (caudal excluded). Diameter of eye 3·85, length of snout 2·25, and interorbital space 3 in the length of the head.

Fifteen gill-rakers on the lower part of the first arch, all small, the anterior ones nearly obsolete. The snout and occiput are concave, the interorbital space flat, with a shallow groove. The cleft of the mouth is nearly horizontal, the maxilla extends to between the nostrils, which are wholly nearer the eye than the end of the snout. Lower jaw the longer. The preopercle is produced backwards at the angle and moderately serrated.

Teeth conical, in a broad patch at the front of each jaw, those on the sides in a narrow band, tuberculate; the anterior teeth rather large, deflected outwards; palate, vomer and tongue edentulous. The symphysis of the lower jaw very acute.

The snout is concave, thence the profile rises abruptly to the dorsal spines and reaches its highest point at the base of the second and third, whence by a low curve it reaches the caudal. The lower profile forms a moderately convex curve.

The first dorsal spine arises above the margin of the preopercle and is rather small, the second is four-fifths and the third twice the diameter of the eye; the next four spines are lengthened: the fourth spine is the longest, one and a half times the length of the head, the fifth somewhat shorter, and the sixth and seventh still more so. The rays take up the decreasing length in regular sequence, the last being equal to the second spine.

The anal commences beneath the eighth dorsal ray, and of the two spines the first is smaller than the first dorsal and the second rather longer than the third. The rays are a little longer than the posterior portion of the soft dorsal and the fin terminates slightly in advance of the dorsal.

The ventral is long, reaching to the second anal ray, and somewhat longer than the head, to which the spine is equal: the pectoral is short and does not reach the anal: the caudal is slightly emarginate.

Scales.—The scales are very small, ctenoid and adherent. Cheeks and two small patches behind the upper part of the eye scaly, the remaining portions of the head naked and sculptured. The lateral line rises from the opercle to a point below the fifth dorsal spine, whence at some distance from the dorsal it takes a rather wavy course to the caudal pedicel, where it becomes horizontal and terminates in advance of the caudal rays.

Colour.—Grey with black markings; the head and the elevation above dark; from the third dorsal spine a black band arises and is directed obliquely backwards and downwards, bifurcating a broader portion reaches the space between the ventral and the anal, while a smaller limb passes indistinctly to the hinder part of the anal. Another band originates below the

fifth and sixth dorsal spines and passes backwards to the upper surface of the caudal pedicel, broadening in its course and enclosing an elongate patch of the ground colour. The whole of the scales bordering the dorsal from the origin of this band are also black. At the base of the caudal rays is an indistinct band and the caudal is tipped with black. All the remaining fins are black except the pectoral, which is of a dirty grey tint.

Total length, caudal included, 200 mm.

This species is nearest allied to *H. labiosus*, Günther,* but while the radial formula agrees with that species, the general proportions of the fins and the relative dimensions of the head and body are very different. *H. labiosus* is much more elongate, has a shorter head and longer snout, a very much smaller eye, and the spinous dorsal lower, not one-fourth the relative height of *H. farnelli;* this latter species also has longer ventrals and a larger number of scales along the lateral line. A comparison of the accompanying figure with that rendered by Günther and Ogilby† shows how greatly the two species differ.

The single example obtained was taken in Shoalhaven Bight, in the comparatively shallow water of 15-18 fathoms. I associated with this interesting species the name of Mr. Frank Farnell, M.L.A., by whose kind offices we were enabled to secure the fine collection to be dealt with.

Family GADIDÆ.

LOTELLA, *Kaup.*

LOTELLA CALLARIAS, *Günther.*

BEARDIE.

Lotella callarias, Günth., Ann. Mag. Nat. Hist., (3), xi., 1863, p. 116. McCoy, Prod. Zool. Vict., Dec. ii., 1878, pl. xix.

Station 24.

Not previously recorded north of Broken Bay, our single example extends its published range to Newcastle, whence it was trawled in 21-48 fathoms. In the northern hemisphere the *Gadidæ* include very many fishes of the highest marketable character, the capture and preservation of which provide food and employment for thousands. It is most deplorable that the few representatives found in southern waters are not only of small size but are accounted of slight value as food.

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* Günther—Proc. Zool. Soc., 1871, p. 658, pl. lix.

† Ogilby—Edible Fishes, N.S.W., 1893, p. 29, pl. vii.

PSEUDOPHYCIS, *Günther.*

PSEUDOPHYCIS BACCHUS, *Forster.*

AUSTRALIAN COD.

Gadus bacchus, Forst., Descr. Anim., Ed. Licht., 1844, p. 120.
Lota breviuscula, Rich., Voy. Ereb. & Terr., Fish., 1846, p. 61, pl. xxxviii., fig. 1.

Stations 24, 25.

This species was twice obtained, both hauls being contiguous to and off Newcastle, the most northern range yet recorded. It was obtained in 21-48 fathoms. An allied species (*P. barbatus*, Günth.) is, according to McCoy, commonly caught with a line all the colder months of the year in Port Philip Bay on rocky reefs in five or six fathoms of water.

Family PLEURONECTIDÆ.

PARALICHTHYS, *Girard.*

Three species of this genus were obtained, namely, *P. arsius*, *P. novæ cambriæ* and *P. tenuirastrum*. Of the first named nothing need here be said; it is an easily recognised species and the records may be taken as accurate. While on board I recognised one other species only, namely, *P. multimaculatus*, obtained at the following Stations :—

1, 4, 5, 6, 9, 10, 11, 12, 22, 23, 24, 26, 27, 28, 31, 39, 41, 43, 44, 46, 47, 48, 50, 51, 52, 54, 56, 57, 58.

Quite recently (December, 1898) Ogilby has pointed out that our commonly regarded *P. multimaculatus* is a distinct species for which he proposes the name *P. novæ cambriæ*. An examination of the "Thetis" *Paralichthys* shows that apart from *P. arsius* the bulk of the specimens taken belong either to *P. novæ cambriæ* or to an undescribed species which I herein name *P. tenuirastrum*. My difficulty is therefore this: I am unable to state, with exceptions, by which of the two species below named each of the above quoted stations is represented. Observations, however, indicate that while *P. novæ cambriæ* is a shallow water form frequenting the sandbanks and mudbanks close in-shore and at the mouths of the rivers, *P. tenuirastrum* is found only in deep water, say from 20 fathoms downwards.

PARALICHTHYS ARSIUS, *Buchanan-Hamilton.*

LARGE-TOOTHED FLOUNDER.

(Fig. 8).

Pleuronectes arsius, Ham.-Buch., Fish Ganges, 1822, p. 128.
Pseudorhombus russellii, Bleek., Atlas Ichth. Pleuron, vi., 1866-72, p. 6, pl. ccxxxiii., fig. 2.

Stations 1, 6, 9, 11, 12, 21, 22, 23, 25, 26, 27, 32, 41, 42, 43, 44, 46, 47, 49, 50, 51, 54, 55, 57, 58.

Described as being essentially a tropical species, the Large-toothed Flounder did not appear to be a whit less common in Shoalhaven than in the Manning Bight (Station 27), and, therefore, probably extends along the whole length of the seaboard of the Colony. Station 54, our most southerly haul, was within Jervis Bay. This flounder was taken most freely in the shallower water, and the greater depth—up to 80 fathoms—yielded but one or two examples.

It is immediately separable from the two following species by the dentition, the canines being of such size as to have earned for the species the popular name here given. There are six gill-rakers on the posterior and thirteen on the lower border of the first arch; their tips are broad and slightly recurved, with the upper border beset with six or more spinules irregularly arranged (fig. 8).

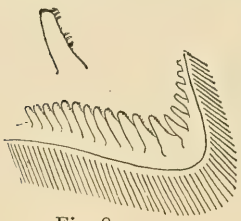

Fig. 8.

A scale taken from behind the curvature of the lateral line has at its free edge about thirty strong marginal teeth and about six rows of smaller teeth at the base of the marginal series.

PARALICHTHYS NOVÆ-CAMBRIÆ, *Ogilby.*

(Fig. 9).

Paralichthys novæ-cambriæ, Ogil. Proc. Linn. Soc. N.S.W., 1898, xxiii., p. 296.
Pseudorhombus multimaculatus (non Günther), Ogil. Edible Fishes, N.S.W., 1893, p. 157, pl. xxxviii.

Stations 1, 9, 10, 22, 23, 24, 26, 27, 31, 39, 50, 51, 52, 54, 58.

Hitherto this flounder has been recorded on our coast only between Cape Hawke and Botany Bay. The former point was within twenty miles of the northern limit of our operations, so

that we cannot extend its known range further than the Manning River in that direction. Southward, however, it was taken more freely, being especially plentiful in the Shoalhaven Bight and obtained at our most southerly Station (54), namely, within Jervis Bay. As before intimated, the list of stations is incomplete and uncertain. The specimens examined revealed the fact that they were in spawn, about half developed, so that approximately the breeding season may be fixed about June. This species was taken more abundantly than *P. arsius*, and was secured more commonly in shallow water.

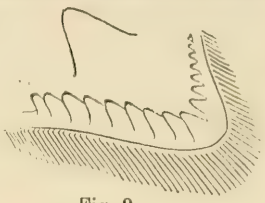

Fig. 9.

The gill-rakers are stout, broad at the base and widely set; seven on the posterior and nine on the lower limb of the first arch; they are almost smooth (fig. 9).

A scale taken from behind the curve of the lateral line has a single row of teeth which is marginal.

PARALICHTHYS TENUIRASTRUM, sp. nov.

(Plate xxviii. and fig. 10.)

Stations 19, 26, 39.

D. 75. A. 60. V. 6. P. 12. C. 15. L. lat. 91.

Length of head 4·3, height of body 2·2 in the total length, (caudal excluded). Upper eye very slightly in advance of the lower, its diameter 5 in the length of the head; interorbital space a narrow bony ridge. Anterior sinistral nostril with a cutaneous margin produced into a tentacle behind; posterior nostril simple; the dextral nostrils are respectively similar but rather smaller. Jaws equal: cleft of mouth oblique, not very large; the maxilla extends to beneath the centre of the orbit, its length 2·6 in that of the head.

Teeth in a single series in each jaw, those of the upper symphysis scarcely enlarged; twenty-seven in each side of the upper and twenty-two in the lower jaw.

The dorsal fin commences over the anterior margin of the upper eye: the longest rays are 2·3 in the length of the head; all the tips of the rays are free. Ventral fins equal, reaching to the second anal ray; the second of the sinistral and the third of the dextral fin the longest, their length 3·1 in that of the head. The pectoral does not extend beyond the curve of the lateral line,

its length 1·6 in that of the head ; the height of the pedicel is 4 in that of the body.

Scales of the upper side subctenoid, almost imbedded, the spinous margin alone exposed. A scale taken from behind the curve of the lateral line is seen to be longer than broad, its posterior margin evenly rounded, its anterior edge truncate ; eight small spines occupy the median third of the breadth near the free edge, but they are not marginal. The scales of the lower side are cycloid, subcircular ; head scaly with the exception of the snout, preorbital and interorbital space ; maxilla scaly in part ; small scales on the rays of the dorsal, anal, ventral and caudal fins. Lateral line arched above the pectoral and continued to the base of the caudal rays. On the head the line skirts the posterior margin of the orbit and passes to beneath the lower eye ; a branch passes forwards from the opercle towards the dorsal surface. Gill-rakers, five on the posterior and twelve on the lower limb of the first arch ; they are closely set, short, not a fourth the diameter of the eye, delicate, narrow and tapering, furnished on their posterior or upper border with nine or less spinules (fig. 10).

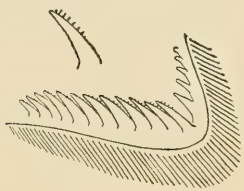

Fig. 10.

Colours.—Greyish-brown above with round black markings having light centres; many are more or less encircled with bright yellow dots. These markings are disposed, four or five along the lateral line, six within the dorsal margin, accurately paired with similar marks within the anal margin ; between the lateral line and these marginal spots, both above and below, is another series of three or four pairs ; two or three faint marks occur over the curvature of the lateral line, and a pair are to be found on the caudal pedicel. All the fins are marked with darker wavy lines ; the dorsal and anal have a series (the former nine and the latter seven) of dark spots midway between the base and margin of the fin and a marginal alternate series of small and fainter marks. At the base of the caudal rays are two dark blotches, the upper of which is the more pronounced.

Total length 265 mm.

As ascertained by the examples preserved, the range of the species is at present known to be from Port Hacking in the south to Port Stephens in the north. It was obtained in 20 fathoms, but it is probable that it finds a home at much greater depths, having been more freely taken in 52 fathoms.

After finding the species was distinct from *P. novæ-cambriæ*, I concluded that we had the true *P. multimaculatus*, but this is

not so; it differs from Günther's species by having the body much more elongate, the maxillary shorter, and the teeth different in character and number. The scales also are much smaller, 91 as against 78 on the lateral line. It is most nearly allied to *P. novæ-cambriæ*, but differs therefrom by its more lengthened shape, the greater number of dorsal and anal rays, the shorter maxilla, not extending beyond the centre of the eye, with its posterior border oblique (almost vertical in *P. novæ-cambriæ*). A very striking difference is presented by the gill rakers, and the foregoing descriptions of isolated scales may also be compared.

The figure of *P. mülleri*, Klunz.,* appears to have been reversed or drawn from a dextral example. In this the lower eye is the anterior one; the number of teeth in the lower jaw is but seven or eight, while the gill-rakers, although short and spiny, are broadened at the free end and truncated, thus differing greatly from those of *P. tenuirastrum*.

AMMOTRETIS, *Günther.*

AMMOTRETIS ROSTRATUS, *Günther.*

LONG-SNOUTED FLOUNDER.

Ammotretis rostratus, Günth., Cat. Fish. Brit. Mus., iv., 1862, p. 458.

Ammotretis adspersus, Kner, Reise Novara, Fische, 1869, p. 286, taf. xiii., fig. 4.

Station 50.

The only example obtained was trawled in Shoalhaven Bight in 15-18 fathoms. The radial formula which it exhibits is:—

D. 80. A. 53. P. 10. V. dex. 7, sin. 4. C. 14. L. lat. 90.

The dextral ventral rays in the type are rendered as six, and, mainly on account of an example possessing seven rays, as in ours, Kner guardedly proposed that if it was not *A. rostratus* it might be called *A. adspersus*. In its shorter body our example agrees with *A. zonatus*, Macl.,† afterwards renamed *A. macleayi* by Ogilby,‡ but later§ sunk as a synonym of *A. adspersus*.

235 mm. is the length of the specimen.

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* Klunzinger—Sitz. K. Akad. Wissen. Wien., 1879, lxxx., pl. ix., fig. 2.

† Macleay—Proc. Linn. Soc. N.S.W., vii., 1883, p. 367.

‡ Ogilby—Proc. Linn. Soc. N.S.W., x., 1886, p. 121.

§ Ogilby—Cat. Fishes, N.S.W., 1886, p. 48.

LOPHONECTES, *Günther.*

LOPHONECTES GALLUS, *Günther.*

CRESTED FLOUNDER.

Lophonectes gallus, Günth., Chall. Report, Zool., i., 1880, p. 29, pl. xv., fig. B.

Stations 1, 2, 4, 7, 9, 11, 13, 28, 33, 35, 37, 38, 41, 42, 43, 44, 46, 47, 48, 49, 50, 54, 55, 56, 57, 58.

It is a matter for regret that this species, the commonest flat fish secured, does not attain larger dimensions. The largest taken did not exceed 7½ inches, while few were more than 6 inches.

Immense quantities of fry, under 2 inches in length, were retained in the trawl whenever mud was brought up, indicating the breeding season to be during the height of summer. Whether these fry frequent the mud only, or whether they are also found in sand and sifted out of the trawl with it, it is not possible to say.

This fish was taken all along the coast from Jervis Bay to the Manning River, and at all the depths tested from 10 to 84 fathoms.

Ogilby has pointed out in the following words that the figure quoted is defective* :—"In Dr. Günther's figure the fish is coloured on the wrong side, the short first dorsal ray is omitted, and there is a separation between the elongate and short rays of that fin, which is purely imaginary."

Family SOLEIDÆ.

ASERAGGODES, *Kaup.*

ASERAGGODES MACLEAYANA, *Ramsay.*

NARROW-BANDED SOLE.

(Plate xxix.)

Solea macleayana, Rams., Proc. Linn. Soc. N.S.W., v., 1881, p. 462. Ogil., Edible Fishes, N.S.W., 1893, p. 159.
Solea fluviatilis, Rams., Proc. Linn. Soc. N.S.W., vii., 1883, p. 111.

Stations 23, 24, 32, 51.

Two interesting and important observations have been made with regard to this species, namely, its distribution and season of spawning.

* Ogilby—Cat. Fishes, N.S.W., 1886, p. 48.

Previously it was known only from a very small portion of our coast line, ranging from Port Hacking in the south to Lake Macquarie in the north. At Station 51 we secured it very freely off the Shoalhaven River in 15 fathoms, while its northern range was extended to Cape Hawke, off which point (Station 32) it was trawled in 10-12 fathoms. As against the plentiful supply obtained it may be argued that it was only taken on four occasions; it will be well, therefore, to point out that this species is most probably an inhabitant of shallow water, and that most of our stations indicate a greater depth than suits it. Station 23 was in 16-19 fathoms; and although 21-48 fathoms was sounded at Station 24 it is quite possible that this fish was taken when the trawl was first lowered, and before it descended to greater depths. It may be further pointed out that it was obtained most abundantly in the shallowest water wherein we trawled, and has indeed been taken in fresh water. Mr. J. D. Ogilby exhibited before the Linnean Society* an example caught in fresh water fifty-eight miles above the mouth of the Richmond River, and Dr. E. P. Ramsay had previously recorded the same species under the name *Solea fluviatilis* from fresh water in the Hunter River.

As far as I am aware, the breeding habits of this species were previously unknown. All the specimens of sufficient size were full of almost ripe ova, and as the extreme dates are the 2nd and 19th March, the end of that month may be approximately determined as the spawning season. Eleven inches is recorded as the maximum size obtained, but eight or nine is about the average. On evidence it is mature at a much smaller size, for a large number of our specimens measuring only six inches in length were in full spawn. As to its edible properties, all on board the "Thetis," where it was freely partaken of, pronounced it to be of admirable flavour.

SYNAPTURA, *Cantor.*

SYNAPTURA NIGRA, *Macleay.*

Black Sole.

(Plate xxx.)

Synaptura nigra, Macl., Proc. Linn. Soc. N.S.W., v., 1881, p. 49.
Ogil., Edible Fishes, N.S.W., 1893, p. 160, pl. xxxix. (outline).

Stations 23, 50.

Of this species Ogilby writes:—"The Sole appears to be a purely estuary fish, never, so far as we can ascertain, having been

* Ogilby—Proc. Linn. Soc. N.S.W., xxi., 1896, p. 817.

recorded from the open sea." This statement now no longer applies, for we took two examples, one off Newcastle, and the other in Shoalhaven Bight. After all, one may naturally expect to find this fish inshore, as it occurs in all the estuaries of the New South Wales coast. Had we trawled in shallower water more specimens might have been taken, those secured having been obtained in 15-19 fathoms.

On the other hand, these isolated specimens are the exception which prove the rule, for a net put down in the upper reaches of the harbour, say the Parramatta River, entraps this Sole in large numbers. It is most freely taken in the slimy grey mud, now such a characteristic feature of the bed of the river, and with which its peculiar colour harmonises so well.

SYNAPTURA FASCIATA, *Macleay.*

Many-banded Sole.

(Plate xxxi.)

Synaptura fasciata, Macl., Proc. Linn. Soc. N.S.W., vii., 1883, p. 14.

Station 10.

D. 75. A. 67. V. 4. P. 6. C. 17. L. lat. (see below).

Length of head 6·6, height of body 2·54 in the total length (caudal excluded). Upper eye very slightly in advance of the lower, its diameter 5·1 in the length of the head. Interorbital space flat, less than the diameter of the eye, being contained 1·5 therein. Nostrils situated in cutaneous flaps, the anterior appendage of the right side is large, longer than the interorbital space, and situated midway between the lower eye and the snout; posterior flap small, immediately in advance of the eye. Nasal tentacles of the blind side relatively similar, but smaller.

Lower jaw the shorter. Cleft of mouth narrow, twisted to the blind side, in each ramus of which is a patch of villiform teeth. Lower margin of head and opercular flap, especially of the left side, with short simple papillæ. The dorsal fin commences over the front margin of the eye, but is preceded by a few papillæ. Two ventrals, similarly developed, separate from the anal, which commences beneath the gill cover. Pectorals very small, each with six rays; on the right side the fin is easily overlooked, that of the left is larger, about four-fifths the diameter of the eye. Caudal moderate, its central rays produced. Entire head, body and fin rays scaly.

Scales of both sides similar, more than twice as long as broad, much expanded at the base, and narrowed suddenly at the free end, which is furnished with from seven to nine slender marginal spines.

Lateral line equally and similarly developed on both sides; it is quite straight from the head to the extremity of the caudal rays; on the head it is strongly arched, and being continued forward it attains the dorsal profile above the eye. The number of pores along the straight line to the base of the caudal is one hundred and two. There are nineteen pores along the curve of the head, and eighteen on the caudal ray.

Colours.—On the upper side dark brown, with twenty transverse brown bars (extending on to the fins), of which five occupy the head; there are two bars on the caudal rays, of which the posterior one is sub-marginal; free portion of all the fins, a narrow edge of membrane, and the whole under side, pale yellow.

Total length of specimen 210 mm.

The single example obtained, and from which the above description is made, was trawled off the coast between Cape Three Points and Tuggerah Lakes, in 28 fathoms.

In his description of this species Macleay states that pectoral fins are absent. I am inclined to think that he overlooked them and perhaps examined only the coloured side where the fin is most inconspicuous, and especially so in an example scarcely more than half the length of ours. Instead, therefore, of belonging to Bleeker's *Achiroides*, it should be assigned to *Anisochirus*, characterised by the left pectoral being longer than the right.

Family ANTENNARIIDÆ.

ANTENNARIUS, *Lacépède.*

ANTENNARIUS NUMMIFER, *Cuvier.*

Chironectes nummifer, Cuv., Mém. Mus. Hist. Nat., iii., 1817, p. 430, pl. xvii., fig. 4.
Antennarius nummifer, Bleek., Atlas Ichth., v., 1865, p. 18, pl. cxcviii.

Station 48.

This species, which has a wide distribution from Africa and India to the South Seas, has been recorded by Macleay from Port Jackson. The only example secured by the "Thetis" expedition was trawled off Wollongong in 55 fathoms.

BRACHIONICHTHYS, *Bleeker.*

BRACHIONICHTHYS HIRSUTUS, *Lacépède.*

Lophius hirsutus, Lacép., Ann. Mus. Hist. Nat., iv., 1804, p. 202, pl. lv., fig. 3.
Chironectes punctatus, Cuv., Mém. Mus. Hist. Nat., iii., 1817, p. 434, pl. xviii., fig. 2.

Station 57.

The only example obtained is very young, less than 15 mm. in length. It was taken from 54-59 fathoms off Wata Mooli.

In his diagnosis and description, Günther * gives as a generic character, "Three dorsal spines, the two posterior of which are connected by a membrane with each other and *with the soft dorsal.*" In our example the spines are unconnected with the soft portion and so agree with Cuvier's figure and with Günther's condensed description of the species: "The anterior dorsal spine is free, terminating in a small lobe; the two others are joined into one fin, *separate from* the soft dorsal."

Our specimen is rather small for specific identification, but on account of the character above mentioned, together with the roughened skin, it should be assigned to *B. hirsutus* and not to *B. lævis*, Lacép., in which the dorsal spines and rays are connected and the skin nearly smooth. Opinion is divided as to the position of *B. politus*, Rich.

The species here chronicled was taken at Twofold Bay in 150 fathoms by the "Challenger"; ours is thus the second example known from the coast of New South Wales, where it appears to be a deep water form and apparently breeding with us. It was first described from Tasmania, which seems to be the head quarters of the genus.

* Günther—Cat. Fish. Brit. Mus., iii., 1861, pp. 178 and 182.

ADDENDUM TO INTRODUCTION.

ADDENDUM TO INTRODUCTION.

Since the foregoing was in type another fishing experiment has been made here, and I am able to supplement the introductory account, and bring the résumé of operations to the end of the century.

The first intimation I had of this latest venture was the following newspaper paragraph :—

"Fishing by Electric Light.—The Fisheries Commissioners are desirous of proving whether fish can be captured by electric light, and have constructed a wire netting trap, which is connected by an electric light apparatus, with a view of undertaking a series of experiments in deep-sea waters for the capture of fish. They have also written to the Colonial Secretary asking whether the 'Thetis' can be lent for the purpose of trying the apparatus, and in their letter they point out that this mode of capture has been very successful at Monte Carlo and that if the experiment proves successful it will form an important factor in connection with the fish supply of the metropolis. The Minister for Works, to whom the request has been referred by the Colonial Secretary, has approved of the 'Thetis' being lent for the purpose of the experiment, and she will be placed at the disposal of the Commissioners for two or three days during next week." *

The Fisheries Commissioners having kindly invited me to witness the experiment, I once more joined the "Thetis," which late on the 24th November, 1899, left the harbour and anchored for the night in Botany Bay. Next day we proceeded southward and stood off Jervis Bay, where the first trial was made. The apparatus, suspended from a boom, was seen to consist of a circular fish-trap eleven or twelve feet in diameter, provided with six entrances. Its central portion was occupied by a square box, the sides of which were formed of silvered glass. An incandescent electric lamp hung in front of each mirror, and before being lowered fish-bait was placed within the trap.

The apparatus was let down in daylight off the John Young Banks into twenty-six fathoms, but five minutes after the dynamo was started the lights went out. The water pressure at the depth attained had apparently been under-estimated, for on hauling the trap it was found that the connections had been damaged and that some of the globes contained water.

We then ran for Jervis Bay for repairs, and here the night was spent. Unfortunately the sea had risen, so that next day (Novem-

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* *Daily Telegraph*, 15th November, 1899.

ber 26th) it was not deemed wise to trust the trap overboard outside the Bay. Having a small Otter Trawl aboard, this was dragged for a short time in the Bay, but the only fishes netted were *Trygonoptera testacea* and *Lepidotrigla pleuracanthica*. A seine net hauled from the shore produced Sand Whiting (*Sillago ciliata*), White Trevally (*Caranx georgianus*), Black Bream (*Chrysophrys australis*), and Mullet (*Mugil dobula*).

I put a tow-net overboard and secured some pelagic organisms.

Shoals of Mackerel (*Scomber pneumatophorus*) were swimming around the "Thetis" as she lay at anchor, and numbers were caught by line in company with Yellow-tails (*Trachurus declivis*). After breakfast we steamed outside and hand-fished the ground between Jervis Bay and Wreck Bay. The following fishes were obtained :—

Gummy (*Galeus antarcticus*).
Fiddler (*Trygonorhina fasciata*).
Sergeant Baker (*Aulopus purpurissatus*).
Nannygai (*Beryx affinis*).
Schnapper (*Sparosomus auratus*).
Sweep (*Cæsiosoma æquipinnis*).
Teraglin (*Atractoscion atelodus*).
Morwong (*Dactylosparus carponemus*).
Maori (*Opthalmolepus lineata*).
Pig Fish (*Lepidaplois oxycephalus*).
Leather Jacket (*Monacanthus ayraudi*).
Red Rock Cod (*Scorpæna cruenta*).
Common Flathead (*Platycephalus fuscus*).
Bass Flathead (*Platycephalus bassensis*).
Flying Gurnard (*Pterygotrigla polyommata*).
Short-finned Pike (*Sphyræna novæ-hollandiæ*).

Returning at dusk to Jervis Bay, the electric fish-trap was later put over in nine fathoms and the lights kept going brilliantly for an hour and a quarter. The area for fully a hundred yards around was well illuminated and Garfishes (*Hemirhamphus intermedius*) could be seen swimming in and out through the wire meshes. When the trap was hauled out of the water it was empty.

It is most likely that the illumination was altogether too brilliant, so that instead of attracting the fish it scared them away. In future experiments it might be well to copy natural illuminants of the water and provide a number of faintly glowing lamps rather than few of excessive brilliancy.

I lowered an incandescent lamp in a tow-net and obtained a number of small Invertebrates, thus reproducing the experiments conducted at the Liverpool Biological Station.

Publications of the Australian Museum.—Continued.

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12,009

AUSTRALIAN MUSEUM, SYDNEY.

MEMOIR IV.

SCIENTIFIC RESULTS

OF THE

TRAWLING EXPEDITION

OF

H.M.C.S. "THETIS,"

OFF THE COAST OF NEW SOUTH WALES,

IN

FEBRUARY AND MARCH, 1898.

PART 2.—Published 23rd May, 1900.

PUBLISHED BY ORDER OF THE TRUSTEES.

R. ETHERIDGE, Junr., J.P., Curator.

SYDNEY, 1900.

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CRUSTACEA.

PART I.

By THOMAS WHITELEGGE.

Zoologist, Australian Museum.

JUL 5 1900

CRUSTACEA.

PART I.

By Thomas Whitelegge,

Zoologist, Australian Museum.

(Plates xxxii.-xxxv.)

The collection of Crustacea obtained during the cruise of the "Thetis" proves to be exceptionally rich in forms either new to science or to the fauna of New South Wales.

Of the forty-five species herein dealt with, twenty are additions to the fauna; nine of which are described as new.

The above remarks apply to the higher Crustacea only; the lower, when thoroughly worked out, will I believe yield a far larger proportion of novelties. Although the "Thetis" collection shows the coastal waters to be so rich, it probably includes but a small portion of our Crustacean fauna. It must be remembered that the "Thetis" Trawling Expedition was fitted out to test the deeper waters off the coast for fish alone; all other organisms were considered of secondary importance. Still Mr. Waite on several occasions contrived means to secure representatives of the smaller forms of life, and succeeded in preserving a very large quantity of material which will yield a rich harvest when fully investigated.

The extreme richness of the fauna of Port Jackson is now generally acknowledged, but many still entertain the idea that the waters off the coast are deficient in fish food, and that there is a scarcity of minute living organisms such as abound in other parts of the ocean. Considering our limited knowledge of the fauna of the deeper waters of the coast, there seems to be some justification for this idea; but if the fauna as at present known is taken into account it is evident that it is scarcely correct, and when the coastal area has been thoroughly explored, there cannot be the least doubt that its waters will be found as richly endowed with life as in any part of the world. In support of this view mention may be made of the vast streams of Pelagic

life which visit these shores annually. This "cycle of matter in the sea" makes its appearance about the middle of January, and is more or less present on the coast until the latter end of June. It consists of millions of living organisms, moving along the crowded sea animal streets, and contains representatives—either as young or adults—of almost all groups of marine life. The number of different species wandering about in one of these sea thoroughfares must be very great; still our knowledge of them is scanty indeed, and will remain so until proper means are taken for their investigation. The results of the "Thetis" Expedition are such that we may reasonably expect to meet with an extremely rich bottom fauna off the coast when it has been systematically explored, and in this connection it is hoped that the Government will furnish the means for a more complete investigation of our marine fauna, particularly in regard to the organisms which constitute the food of fishes.

As an instance of the remarkable wealth of life, at moderate depths off the coast, mention may be made of a stone that was acquired by the Museum in May, 1898. See Plate xxxii.

In order to fully realise the number of organisms living on this stone, it will be necessary to give some account of how it was obtained and the treatment it subsequently received. A man while fishing in 30 fathoms off Long Reef, near Manly, suddenly found his line fast, and after much tugging, finally succeeded in hauling it up. When the leaded end neared the surface he saw that his line had become entangled round the stem of a large "sea-fan," the base of which was attached to the corner of a stone nearly thirty pounds in weight. The stone was placed in the bottom of the boat, and when the fisherman returned home he took it with him for the sake of the beautiful "sea-fan." During this rough handling many small active Gasteropods, Annelids, Amphipods, Isopods and Echinoderms doubtless escaped. Next day this object was brought to the Museum, and was handed over to me for preservation. It was washed in fresh water to remove the salt, and the organisms disturbed were carefully collected. The stone is irregularly oval in shape, measuring 35 cm. in length, 26 cm. in breadth, and 10 cm. in height or thickness. The Gorgonia or "sea-fan" which is attached at one corner is a species of *Juncella*, measuring 90 cm. in height, 60 cm. in breadth; the greatest diameter of the stem does not exceed 8 mm., while its base forms a circle of about 30 mm. across.

The whole of the upper surface of the stone is completely covered with animal growths, so that it is impossible to see any portion of the original surface; one patch about the size of a half-crown appeared to be like the naked rock, but is found to be a dried Compound Ascidian.

The smaller objects in the following list have been determined by means of a hand-lens; the specimens are so numerous and so closely packed that it is difficult to bring them into focus, owing to a miniature forest of projecting stems, branches and worm tubes. Were it possible to apply the microscope direct the number of species might be considerably increased; these remarks apply more especially to the Polyzoa, which cannot be determined in their present position, and their removal from the stone would entail their destruction as well as the objects near them.

The following is a list of the species attached to the stone, and also of the free or active ones, as ascertained by an examination of the residue of the fresh-water washing :—

Foraminifera.

ATTACHED OR FIXED. ACTIVE OR FREE.

Polytrema miniaceum, Linn.
Haliphysema, sp.

Porifera.

Sycon gelatinosum, Blainv.
„ sp.
Ute, sp.
Hircinia, sp.

Alcyonaria.

Juncella, sp.
Acanthoisis flabellum, Wright and Studer.
Plumarella penna, Lamarck.
Primnoella australasiæ, Gray.
„ *grandisquama*, Wright and Studer.
Telesto smithii, Gray.
Cornularia ? australis, Busk.

Madreporaria.

Balanophyllia bairdiana, Edwards and Haime.
Flabellum, sp.

Echinodermata.

Antedon macronema, Muller ? *Holothuria*, sp.

CRUSTACEA.

ATTACHED OR FIXED.

Balanus trigonus, Darwin.

ACTIVE OR FREE.

Pilumnus, sp.

Thalamita prymna, M. Edwards.

The Amphipoda are represented by one hundred and fifty specimens, belonging to about ten species and five or six genera.

The Isopoda number two hundred and twenty examples, representing twelve or more species, belonging to nine genera, among which are the following:—*Sphæroma*, *Cirolana*, *Apseudes*, *Gnathia*, *Arcturus*, *Serolis*.

VERMES.

Six species of Tubicolous worms, belonging to about four genera.

POLYZOA.

Retepora, sp.
Tubucellaria hirsuta, Lamouroux.
Craspedozoum roboratum, Hincks.
Catenicella, sp.
,, sp.
Caberea, sp.
Cellepora, sp.
,, sp.
Amphiblestrum cervicorne, Busk.
Schizoporella, sp.
Idmonea, sp.
Tubulipora, sp.
Lichenopora, sp.

MOLLUSCA.

Spondylus tenellus, Reeve.
Vermetes, sp.
Chiton, sp.

TUNICATA.

Compound Ascidian.

The above enumeration includes eight distinct groups or classes, over fifty genera and sixty-five species, with a total of three hundred and seventy-two free individuals, and it may be estimated that fully a third of the once denizens of this square foot of the floor of the Pacific was lost after its entanglement in the fisherman's line. What the original population of this stone may have been is impossible to say; it would probably be less difficult to estimate the quantity of sand grains in the stone than to ascertain the number of individual organisms still remaining on its surface.

The collection of Crustacea dealt with in subsequent pages comprises about seven hundred and twenty specimens, representing thirty-eight genera and forty-nine species. The following are described as new:—

Pugettia mosaica.
Chlorinoides waitei.
Paramithrax tuberculatus.
Pilumnus australis.
Paguristes tuberculatus.
Sympagurus diogenes.
Glaucothoë hexagonata.
Porcellano-pagurus tridentatus.
Galathea, sp.
Arctus crenatus.

It has been found necessary to re-describe some of the known species, either wholly or in part. These are:—

Pilumnus tomentosus, Latreille.
„ *rufo-punctatus*, Stimpson.
Gonioneptunus subornatus, Ortmann.
Pilumnoplax abyssicola, Miers.
Mursia armata, DeHaan.
Homola orientalis, Henderson.
Clibanarius strigimanus, White.
Glaucothoë carinata, Henderson.
Galathea pusilla, Henderson.
„ *magnifica*, Haswell.
„ *australiensis*, Stimpson.
„ *corallicola*, Haswell.
„ *aculeata*, Haswell.
Munida haswelli, Henderson.
Pseudosquilla stylifera, Milne Edwards.

The following species have not previously been recorded for New South Wales, and those preceded by an asterisk are new to the fauna of Australia :—

Achaeus tenuicollis, Miers. (*Hab.* : Bass Straits and Port Phillip.)

**Naxia robillardi*, Miers. (*Hab.* : Mauritius.)

Pilumnus tomentosus, Latreille. (*Hab.* : Bass Straits and Port Phillip.)

**Gonioneptunus subornatus*, Ortmann. (*Hab.* : Japan.)

**Goniosoma miles*, DeHaan. (*Hab.* : Japan.)

**Pilumnoplax abyssicola*, Miers. (*Hab.* : Fiji.)

**Mursia armata*, DeHaan. (*Hab.* : Fiji and Japan.)

**Homola orientalis*, Henderson. (*Hab.* : Little Ki Island; Philippines.)

**Pontocaris propensulata*, Bate. (*Hab.* : Off Ki Island.)

**Pseudosquilla stylifera*, Milne Edwards. (*Hab.* : Chile and San Pedro; California.)

**Squilla armata*, Milne Edwards. (*Hab.* : Chile and New Zealand.)

BRACHYURA.

OXYRHYNCHA OR MAIOIDEA.

Legion I. MAIINEA.

Family INACHIDÆ.

Subfamily LEPTOPODIINÆ.

ACHAEUS, *Leach.*

ACHAEUS TENUICOLLIS, *Miers.*

Stations 35, 37.

Achaeus tenuicollis, Miers, Chall. Rep., Zool., xvii., 1886, p. 9, pl. i., fig. 3.

Eleven examples of this well-marked species were obtained at Stations 35 and 37, off Port Hacking and Botany Bay at depths ranging from 22 to 52 fathoms. This form has not been previously recorded for New South Wales. The Challenger examples were obtained off Port Phillip, Victoria, and in Bass' Straits.

Subfamily ACANTHONYCHINÆ.

PUGETTIA, *Dana.*

PUGETTIA MOSAICA, sp. nov.

(Plate xxxv., figs. 5, 6, 7.)

Stations 13, 35, 36, 37, 41, 42, 44, 57.

Carapace subpyriform, slightly longer than broad, densely covered with minute bead-like granules, rostral spines, gastric and lateral branchial regions with a few slender hooked setæ; the upper surface is marked by two elevated bosses, one on the cardiac and the other on the intestinal region; a short marginal spine is present on each hepatic, and a large one is seated on each branchial region; the pair of branchial spines is in a transverse line with the cardiacal elevation. Rostral spines short, acute, as long as the interorbital space is wide, divergent and deflected towards their apices. Preocular spine small, triangular and subacute; the postocular is separated from the orbital margin by a V-shaped fissure, and from the hepatic spine by a wide sinus; viewed from above its outline is narrow and acute, the inner margin being granulose and the outer smooth; when seen from its lateral aspect the outline is oblong with rounded ends, the surface being smooth, white and slightly concave.

The eyestalks and the joints of the antennæ are more or less beset with minute granules. The basal joint of the second antenna is somewhat narrowed distally, the outer margin is thin and acute, the base is rounded, and the apex terminates in a triangular tooth; the outer superior and the central surfaces are minutely granulose; the granules on the latter are situated in a longitudinal groove, and are bounded above and at the sides by a smooth marginal band.

Chelipedes in adult male as long as the carapace and rostral spines; merus joint trigonus, outer angle obtuse, granulose, inferior and superior borders with a thin acute keel, granulose on the inner side; inferior surface convex, smooth.

Carpus a little longer than deep, about equal in length to the diameter of the merus; external surface granulose; inner granulose setose; upper surface smooth, with an acute arcuate keel.

Hand compressed, sharply keeled above and below, scarcely twice as long as the depth of the palm; inner and outer surfaces

of the latter smooth, except the inner superior margin, and the distal and proximal extremities. Fingers acute, their inner edges with five or six denticles on their distal half; upper surface of mobile finger granulose, with two smooth longitudinal ridges; immobile finger slightly granulose at the base. Ambulatory legs rather elongate, gradually diminishing in size posteriorly, the first nearly twice as long as the fourth without the tarsus. Merus joint of the first leg equal in length to the carpus and propodus, subcylindrical, with a thin even carina on the upper surface, commencing at a short distance from the base and continued to near the distal extremity.

Outer aspect of crest and upper posterior surface quite smooth; inferior and anterior granular and setose. Carpus shorter than the tarsus, depressed, a little broader distally than proximally, smooth and grooved above, granular and setiferous at the sides and below. Propodus rounded, sensibly diminishing in diameter towards the extremity.

Tarsus subcylindrical, slightly shorter than the preceding joint, straight, except at the tip, which is hooked; surface granulose-setose, but not spinose.

The meral joints of the third and fourth legs are similar to those of the second, except that the keel is shorter and confined to the distal half of the joints; on the merus of the fifth the keeled is represented by a compressed tooth.

In the female the post-abdomen is six-jointed, the chelipedes are weak, and the hands small; the upper and lower borders of the latter are rounded; the whole of the outer surface of the palm and the upper and lower third of the inner are closely granulose.

This species may be separated from those previously described by the granulation of the carapace and limbs, and by the character of the postocular spine, which not only differs in shape but is quite distinct from that on the hepatic region. It also wants the conspicuous granules on the pterygostomial which are present in *Pugettia incisa* and *P. quadridens*. From *P. minor* it differs in the absence of a distal spine on the merus, and in having the outer angle obtuse and granulose.

Colour.—Uniform pale cream.

Length of carapace, including rostral spines, 14 mm; breadth 8 mm.

Forty-seven specimens of this interesting form were obtained, ranging from Cape Three Points to Wata Mooli, and at depths varying from 20 to 59 fathoms.

Family MAIIDÆ.

Subfamily MAIINÆ.

CHLORINOIDES, *Haswell.*

CHLORINOIDES WAITEI, sp. nov.

(Plate xxxiii.)

Stations 2, 21, 22, 25, 36, 41, 42, 57.

Carapace strongly spinose, about one-tenth longer than broad. Regions well-defined, convex, limited by wide grooves, which are more or less interrupted by elevations; between the latter are situated narrow pit-like depressions; anteriorly they are few, large and isolated, posteriorly they are numerous, small, segregate and somewhat plicate, especially on the boundaries of the cardiac and intestinal regions. Body sparsely clothed with hooked setæ; a few also occur on the upper surfaces of the limbs.

Carapace and legs more or less covered with very short stiff setæ; the latter on the ambulatory legs arise from small bead-like granules, occasionally they spring from the summit but generally from the base; these setæ are directed towards the distal extremities of the limbs. The granules on the hands of the chelipedes are smaller and closer than elsewhere, and are devoid of setæ. The setæ are so minute that they can only be seen with a lens, and in no way interfere with the apparent smoothness of the body and limbs, yet they are very evident to the touch.

Rostral spines tapering, straight, acute, separated by a narrow V-shaped space, 20 mm. deep and 12 mm. wide at the summit.

The larger spines on the carapace are disposed as follows:—

1. A median series of four, two on the gastric, one on the cardiac and one on the intestinal region.

2. A submedian series of twelve, arranged transversely in six pairs, of which two pairs are situated on the interorbital space in a line with the rostral spines, two on the gastric region, one on the cardiac and one on the posterior border. There are also two obliquely placed pairs on the anterior intestinal region.

Inner orbital border smooth, prominent, terminating outwardly in a strong curved spine, the upper surface bearing two irregular rows of spiniform granules; inner orbital fissure wide, outer

narrower above than below; interfissural spine of moderate size, with a supplementary spine behind at its base; outer angle of the orbit bispinose, with an accessory spine situated externally about midway between the apex and the base.

Hepatic region prominent, with a series of small spines both above and below, and two strong spines on the margin, of which the anterior is much the larger.

Branchial region beset with numerous spines and tubercles; a series of five large spines form a semicircle along the elevated margin, all equidistant save the last, which is nearer; a line drawn from the fourth one of the series to the tip of the rostral spine would pass over two other strong spines, one on the gastric and the other on the anterior branchial region.

There is a small blunt spine on the pterygostomial region, immediately below the hepatic spine.

The very stout basal joint of the outer antenna terminates in two strong spines; the external and larger spine is directed upwards; it possesses two accessory spinules, one on the outer margin midway between the apex and the base, and the other on the inner margin and in contact with the front of the orbit. The inner spine is directed forward and slightly outwards; a small spinule is present near its inferior base.

Chelipedes in adult male large, and nearly twice the length of the carapace. Merus joint equal in length to the palm, twice as long as the carpus, armed below with a single longitudinal row of three or four, and above with two rows of six unequal spines or spinose tubercles. The distal extremity bears four spines, one on the outer, one on the inner angle, and two in a median line superiorly; the posterior one is rather large, and slightly exceeds another spine situated at about the distal two-thirds. Carpus with numerous subspiniform tubercles and a few spines; the former are irregularly distributed on the external and upper surfaces, but they are more prominent on the ridges, as are also the spines, of which there are two proximal and one distal in a median line on the rounded upper border. Hand compressed, especially in the upper fourth; surface, including fingers, apparently smooth, but covered everywhere with a fine, close bead-like granulation; palm twice as long as deep, and a little longer than the mobile finger.

Fingers with a large gap at the base when closed, their inner edges acute and denticulated distally, broad, rounded and transversely ridged proximally. Ambulatory legs long, somewhat slender distally, gradually decreasing in size posteriorly; the first pair are twice as long as the fifth pair without the tarsus. Lobes above the bases of all the legs except the chelipedes terminating

in a large, acute, triangular spine. Merus joint of anterior leg as long as the carpus and propodus, cylindrical but perceptibly narrowed in the middle, transversely dilated, and three-lobed distally; the median lobe is tipped with a short spine; a similar spine is present on the middle lobe of each succeeding pair of legs.

Carpus as long as the calcified portion of the tarsus, depressed and much narrower proximally than distally, with a wide, shallow, longitudinal groove above and below; a short lateral spine is present on the inner surface near the distal extremity, and there are traces of a second one in the same line about the middle of the joint. Propodus slender, cylindrical, increasing slightly in diameter towards the extremity, about twice as long as the carpus measured along the inner side. Tarsus curved, its basal two-thirds cylindric, the last third tapering and densely clothed at the sides with short stiff setæ, distally terminating in a strong, acute, horny claw.

Colour.—When alive pale olive, with red markings. In the dried example the colours have faded; the upper surface of the carapace is now dullish red; the lateral sides of the branchial regions and the spines are more or less cream, with small red spots.

The fingers and the lower part of the hand are pale cream; the outer surface of the palm has a few elongate, transverse, red blotches, and on the inner surface the blotches are numerous, more especially on the upper half. The upper surfaces of the meral and carpal joints are of varying shades of red, those of the first pair being bright, deep and somewhat glossy, and dotted here and there with cream coloured spots; the second pair are similarly coloured, but the surface is dull; the succeeding pairs have a cream ground, with numerous blotches and spots of red; a few small spots are also present on the propodal joints.

The female does not differ materially from the male, the chelipedes are, however, weaker, shorter, and the hands are much less.

The following measurements are taken from a large adult male:—

Length of carapace	140 mm.
Breadth of „	125 „
Length of right chelipede	227 „
„ „ „ first ambulatory leg	229 „
„ „ „ fourth „ „	195 „
„ „ rostral spine	20 „
„ „ larger spines of carapace	16 „

Twenty-six examples of this remarkably fine species were obtained, including a few young under 20 mm. in length. The

armature of the carapace and limbs is if anything more pronounced in the young than in the adult; the spines appear proportionately longer, but this appearance is due to their bases being narrower and not so much swollen and elevated as in the adult. This species appears to be quite distinct from any hitherto described.

PARAMITHRAX, *Milne Edwards.*

PARAMITHRAX TUBERCULATUS, sp. nov.

(Plate xxxiv., figs. 1, 2.)

Stations 10, 35, 37, 41, 42.

Rostral spines short, acute, slightly divergent, about twice as long as broad at the base.

Carapace subpyriform, about one-fifth longer than broad; regions prominent and sharply defined; inner limit of branchial with four equidistant pits, and a large depression on each side of the intestinal region. Upper surface with numerous tubercles and a few spines; there is a median series of three spines, two on the gastric and one on the cardiac; the latter region is centrally surmounted by an elevated, transverse, confluent pair, and a small pair is present on the posterior border.

A series of submedian tubercles is disposed as follows:—Two widely separated pairs on the interorbital space, a pair about their height apart on the anterior, and four equidistant in a transverse line on the posterior gastric region, and a pair on the intestinal, situated immediately in front of a median subspiniform tubercle. Upper orbital border, hepatic, anterior cardiac and branchial regions with numerous small tubercles; a few of a larger kind are scattered on the gastric and branchial regions.

The tubercles are clothed with minute granules, and are surmounted with hooked hairs.

Inner orbital fissure twice as long as wide, bounded on the inner side by a short triangular tooth, and on the outer by a granulose spine; outer fissure deep, narrow, and almost closed above; external orbital angle acute but not spinose.

Hepatic region prominent, with two short lateral spines and a few granules on the swollen inferior surface. Margin of branchial region bearing four spines, rather more than twice their length apart; first and second compressed, granulose superiorly; third and fourth smooth, conical, the last one arising from a broad elevated base.

The sides of the branchial regions below the spines are concave, smooth, shining, and clothed with remote, adpressed, microscopic hairs. The posterior border is acute and minutely tuberculate.

Basal joint of outer antenna terminating in two spines: the outer is directed upwards and outwards; its apex is in a line with and projects slightly beyond the front of the orbit; the outer margin and the apex superiorly are tuberculated. Inner spine short, triangular, directed forwards and outwards.

Chelipedes in adult male of moderate size, equal in length to the carapace and rostral spines; merus joint as long as the upper border of the hand, beset with tubercles similar to those occurring on the carapace, the larger of which are seriate; three form a longitudinal row on the inferior surface; another row of three occurs on the inner proximal portion of the upper border, and there are two or more in a line with a blunt median spine, situated at the distal extremity.

Carpus obtusely angulate, a little shorter than the mobile finger; outer and upper surfaces with numerous small tubercles; a large spiniform tubercle marks the junction of the angles proximally.

Hand measured along the lower surface twice as long as deep, tumid and rounded below, narrow and somewhat angular in the proximal half above; surface minutely granulose, and more or less clothed with distant, adpressed, microscopic hairs. Fingers with lines of pits on their lateral surfaces; inner edges acute and minutely denticulate distally, proximally each has a slight lobe; the lobe on the mobile finger is a little in advance of and is adapted to a depression anterior to that on the lower; there is a slight hiatus at the base when the fingers are closed.

Ambulatory legs elongate, slender, decreasing in size posteriorly; the anterior are about twice as long as the carapace is broad. Merus joint rounded, perceptibly increasing in diameter in the distal half, about as long as the carpus and propodus combined.

Carpus depressed and slightly grooved both above and below, nearly twice as wide distally as proximally.

Propodus cylindric, twice as long as the carpus.

Tarsus curved, compressed, about one-tenth shorter than the preceding joint.

Joints of all the legs more or less covered with minute, adpressed hairs; fourth, fifth and sixth with tufts of hooked setæ along their upper borders; the seventh bears numerous short stiff setæ, which are confined to the borders; the lateral surfaces are glabrous and longitudinally grooved.

The female differs from the male in having smaller and more slender chelipedes; the hand is much less tumid, and three times

as long as deep; the basal lobes on the inner edges of the fingers are wanting, and the post-abdomen has a marginal fringe of setæ.

Length of carapace 40 mm., breadth 31 mm.

The differences between this species and *Paramithrax sternicostulatus*, M. Edwards, to which it is closely allied, may be enumerated as follows:—

	P. tuberculatus	*P. sternicostulatus.*
External orbital angle	acute	truncate
Inferior surface of body and sides of branchial region	smooth	closely granular
Number of depressions in sternal plate between insertion of the chelipedes and buccal orifice	one	six
Post-abdomen and maxillipedes ...	glabrous	densely setose
External ridge on carpus of chelipedes	rounded	keeled
Hooked setæ on body and limbs ...	few	many
Spines of rostrum and on posterior border of carapace	short	long
Number of spines on branchial margin	four	three

Colour.—In spirit, ground cream, more or less tinted with light red, becoming deep red in the median line of the carapace.

Sixteen examples were obtained. The range extends from Broken Head to Wata Mooli, the depth varies between 20 and 78 fathoms.

NAXIA, *Milne Edwards.*

NAXIA (NAXIOIDES) ROBILLARDI, *Miers.*

Naxia (*Naxioides*) *robillardi*, Miers, Proc. Zool. Soc., 1882, p. 339, pl. xx., figs. 1 and 1*a*, 1*b*, 1*c*. Pocock, Ann. Mag. Nat. Hist., (6), v., 1890, p. 79.

Stations 20, 21, 22, 24.

Nine specimens—five males and four females—were obtained off Morna Point and in the Newcastle Bight at depths varying from 21 to 48 fathoms. The examples are smaller than the types, from which they do not otherwise differ. In the largest male the carapace is 55 mm. long and 40 mm. broad; the rostral spines measure about 40 mm. The first ambulatory limbs are 150 mm. in length.

Hitherto only recorded from Mauritius.

Subfamily MICIPPINÆ.

MICIPPA, *Leach.*

MICIPPA SPINOSA, *Stimpson.*

Micippa spinosa, Stimpson, Proc. Acad. Nat. Sci. Philad., 1857, p. 217. Miers, Chall. Rep., Zool., xvii., 1886, p. 70, pl. viii., fig. 2.

Station 28.

A small, much damaged specimen is in the collection from Station 28, off the Manning River; depth 22 fathoms.

CYCLOMETOPA OR CANCROIDEA.

Legion I. CANCRINEA.

Family CANCRIDÆ.

Section CANCRINÆ.

PILUMNUS, *Leach.*

PILUMNUS TOMENTOSUS, *Latreille.*

Pilumnus tomentosus, Latreille, Encyclopédie Methodique, x., 5, 1825, p. 125. H. Milne-Edwards, Hist. Nat. Crust., i., 1834, p. 418. Miers, Zool. Col. "Alert," Crust., 1884, p. 220; Chall. Rep.; Zool., xvii., 1886, p. 160, pl. xiv., fig. 4.

Stations 12, 21, 37, 41, 44, 48.

Carapace moderately convex, punctate, smooth, or with a few isolated granules, about one-fifth wider than long, covered as well as the limbs with simple yellow hairs, which are about 0·2 mm. apart, and from 0·5 mm. to 1·5 mm. in length; those measuring over 0·8 mm. are confined to the ambulatory legs. Regions pretty well defined anteriorly.

Frontal lobes rounded, somewhat prominent, with a median V-shaped notch; each lobe bears about eight subspiniform denticles, and is bounded externally by a shallow sinus and a

spine, which is situated at the apex of the infero-lateral process of the front.

Outer orbital angle defined by a small spine. Upper margin of orbit with two shallow notches, outer two-thirds smooth, the inner third bears a few granules ; lower orbital border with six or seven subspiniform granules, of which the innermost is large and visible from above.

Anterior lateral margin armed with four spines ; the first is seated on the subhepatic region, and is rather nearer to the orbital spine than to the second, its inferior base is slightly granulose ; the second spine is compressed, acute, and often has one or two granules immediately behind the apex ; third and fourth spines smooth, conical and acute.

Chelipedes robust, unequal, either left or right the larger ; anterior angle of ischium joint subacute and granulose ; merus trigonus, broader than long ; surfaces smooth, punctate, glossy and sparsely hairy ; inferior angle rounded, superior acute, granulose, and armed distally by two spines, one terminal and the other posterior to a deep transverse groove.

Carpus as long as broad, equal to the merus in length, armed on the external and superior surfaces with from twelve to twenty spines, which are a little higher than broad at the base ; they arise from small mound-like elevations, giving the surface a somewhat uneven aspect, and there is a moderate sized spine at the intero-distal angle.

Lower margin of larger hand twice as long as the upper, and equal to the depth of the palm at the base of the fingers ; inner surface of the palm smooth, convex centrally, and excavated at the base proximally. Crest of upper border with five spines, the two anterior are in contact at the base ; upper surface spinose ; the lower and distal external surfaces bear numerous subspiniform granules ; an oblique line drawn from the base of the mobile finger to the lower articulation of the palm would separate the spines from the granules, which gradually diminish in size towards the lower border, the distal third of which is smooth.

Fingers dark brown, the colour being confined to their surfaces ; their inner edges bear three or four denticles, those on the lower being slightly the larger ; the denticles and tips of the fingers are whitish in colour ; the lower finger has both surfaces grooved, but the upper is grooved externally only.

Anterior surfaces of the meral and carpal joints of the ambulatory legs punctate, smooth ; posterior surfaces and the rest of the joints beset with longish hairs. Merus joint trigonus, as long as the inferior borders of the carpus and propodus, that of the first

being slightly granulose below, and has a small spinule superiorly at the distal extremity.

Carpus longer than the propodus, about equal to the tarsus; that of the first leg has a minute spinule at its outer distal apex.

Propodus slightly compressed, deepest about the middle.

Tarsus rounded, tapering gradually to the short but little curved horny claw.

Post-abdomen seven-jointed in both male and female, closely covered with hairs, similar to but shorter than those on the carapace; the female has a marginal fringe of long setæ.

The spines and granules are generally of a bright red colour.

Length of carapace (male)	...	...	...	15	mm.
Breadth	,,	,,	...	...	...	18	,,
Length	,,	(female)	...	...	...	17	,,
Breadth	,,	,,	...	...	...	20	,,

Thirty-two examples were obtained. The range extends from Cape Three Points to Wollongong, and the depth 23 to 71 fathoms.

Mr. E. J. Miers, in his remarks on *Pilumnus rufo-punctatus*, Stimp., states* that Stimpson's species "possibly is itself to be identified with *P. tomentosus*, Milne Edwards." It is again referred to in the Challenger Report,† and the opinion expressed that *P. rufo-punctatus*, Stimp., "may be the true *Pilumnus tomentosus*, Latreille."

It seems quite possible that the original description given by Latreille was ignored in dealing with this species. Had it been consulted I feel sure that the conclusion arrived at would have been different. The brief diagnosis of Latreille agrees with examples of those here regarded as *P. tomentosus*, and further, it does not accord with specimens of *P. rufo-punctatus*, Stimpson. There are several characters exhibited by the latter species which have not been noted. The carpal and propodal joints of the ambulatory legs are armed posteriorly and superiorly with numerous subspiniform granules, similar to but smaller than those on the carpal joints of the chelipedes. The hairs on the carapace and limbs are very short, and measure from 0·3 to 0·4 mm. in length; each hair bears a subterminal cluster of branchlets; the latter are confined to a space about 0·06 mm. in length. The branchlets are generally covered with flocculent matter, and the hairs appear to be capitate when seen under a low magnifying power.

The hairs on the carapace of *Pilumnus tomentosus* measure 0·5 to 0·8 mm. in length, and they are quite smooth and unbranched.

* Miers—Zool. Coll. "Alert," Crust., 1884, p. 220.

† Miers—Chall. Rep., Zool., xvii., 1886, p. 160.

PILUMNUS AUSTRALIS, sp. nov.

(Plate xxxv., figs. 1-4.)

Stations 44, 49.

Carapace slightly convex, a little longer than broad, clothed as well as the limbs with fine short hairs and numerous stiff, elongate, yellow setæ; the latter arise from small pits with elevated margins, which render the surface very uneven, otherwise the surface is smooth and glossy.

Front prominent, with about ten denticles; lobes rounded, separated by a shallow V-shaped notch; each lobe is bounded laterally by a small sinus, and a cylindrical spine is present immediately above the subfrontal process.

Upper orbital border smooth, nearly entire, with only the faintest trace of a sinus; inner and outer angles of orbit without spines or granules externally at the junction of the upper and lower borders; the margin is thin, elevated, and exhibits a very shallow angular sinus.

Lower border of the orbit minutely denticulate externally, and a moderately large spine on the inner angle; the spine has a broad base and tapers to an acute apex; subocular, subhepatic, antero-lateral, branchial, upper and inner pterygostomial regions more or less granulose, a few of which are subspiniform.

Anterior lateral border armed with three elongate and equidistant spines; the second is a little longer than the first and much longer than the third; the first spine is slightly curved and directed forwards; each spine bears two or more stiff setæ; they arise at about one-third from the base and continue parallel with the spine, and frequently exceed the latter in height.

Chelipedes unequal, the right or the left the larger. Anterior edge of ischium joint denticulate Merus as broad distally as long; inner surface smooth and shining; outer and inferior surfaces minutely granulose; anterior border acute, with two unequal spinules proximally; lower border rounded, granulose, the granules becoming larger distally; superior border acute, with four spinules, two small about the middle, and two large—one distal and the other posterior to a shallow transverse groove.

Carpus as broad as long, equal to the merus in length; inner surface granulose; margin angular, tipped with a spine; upper and external surfaces armed with about fifteen acute spines, subequal in size and in distance apart; numerous stiff setæ occur at the bases and between the spines, the rest of the surface is smooth.

Lower border of the hand nearly equal to the merus and carpus combined; upper border shorter than the depth of the palm at the base of the fingers; inner surface of palm convex, smooth, glossy, with or without one or more minute granules near the centre; distal and outer lower surface smooth; upper and external surfaces spinose and setose; the spines are shorter and stouter than those on the carpus; the proximal half of the lower border is somewhat angular and granulose.

Fingers dark brown, the colour failing to reach their bases; inner margin of each armed with four denticles, those on the lower being the most distinct; mobile finger granulose at the base, without grooves; immobile with a groove on each side.

Ambulatory legs moderately elongate; the first is the shortest; the merus joint is trigonus; the superior border is arcuate and acute, and has four small curved spinules on the median portion and a straight spine at the distal extremity; the inferior borders are more or less granulose; anterior and posterior surfaces naked and smooth in all the legs, except the last pair, in which the merus is clothed with short hairs and stiff setæ.

Carpus about one-fourth shorter than the propodus; a little compressed; its depth is greatest at the distal end, and the upper border has three longish spinules, two on the proximal half and one at the distal extremity.

Propodus subcylindrical, deepest about the middle, with the lower border arcuate, unarmed but clothed with long setæ.

Tarsus a little longer than the carpus, compressed, tapering to the short hooked claw; upper border with numerous short hairs, lower with a few short curved setæ.

Inner margin of merus joint of the external maxillipedes somewhat produced and denticulate.

The description has been drawn from an adult male; the female does not present any marked differences.

This species is closely allied to *Pilumnus normanii*, Miers, but differs from it in having the lower external surface of the palm smooth, in wanting an external orbital spine, and in having the meral and carpal joints spinulose

Length of carapace	7·5 mm.
Breadth ,, ...	9 ,,
Length of larger chelipede	12 ,,
Depth of palm at base of fingers	4·5 ,,
Length of first ambulatory leg	11 ,,
,, of third ,, ,, ...	13 ,,
,, of spines on carpal joints	0·9 ,,
,, of second antero-lateral spine ...	1·5 ,,
,, of inferior orbital spine	0·8 ,,

Five examples of this form were obtained—four females and one male, off Coogee and Port Kembla, in 49 to 75 fathoms.

Family PORTUNIDÆ.

Section PORTUNINÆ.

NEPTUNUS, *De Haan.*

NEPTUNUS PELAGICUS, *Linn.*

Neptunus pelagicus (Linn.), A. Milne-Edwards, Archiv. Mus. Hist. Nat., x., 1861, p. 320. De Haan, Fauna Jap., Crust., 1835, p 37, pls. ix. and x.
Neptunus bituberculatus, Miers, Ann. Mag. Nat. Hist., (4), xvii., 1876, p. 221.

Stations 12, 23, 24.

Four specimens of this common species were obtained. They exhibit considerable variation in the granulation of the carapace, in the size of the median frontal teeth, and in the relative elevation of the tubercles seated on the cardiac region.

For comparison a large number of examples—both dried and in spirits—from Port Jackson, have been examined; these also exhibit similar variations. In the largest male the carapace measures 85 mm. by 182 mm. (lateral spines included). The chelipedes are about 305 mm. in length; the median frontal teeth measure 2 mm. The tubercles on the cardiac region are ill-defined, and not more distinct than a pair situated on the anterior gastric region. The granules on the carapace are few, small, subacute and distant, those seated on the main transverse lines are 1·5 mm. or more apart; on the shorter anterior transverse lines and in the central regions they are somewhat closer, whilst on the branchial regions they are more widely separated, varying from 2 to 3 mm. in distance apart.

In another male example the granules and median frontal teeth are very small. The tubercles on the cardiac region are,

however, very distinct, each tubercle being surmounted by numerous small granules, which occur in groups of two and three; a broadish band of similar granules extends from the tubercles to the intestinal region.

In the largest female example the carapace measures 78 by 170 mm.; the right chelipede is 185 mm. in length. The median frontal teeth are minute and unequal; the larger one measures 0·7 mm. The rounded granules on the transverse lines are about 0·6 mm. in diameter, and the same or less in distance apart; on the central regions they are slightly larger and crowded, but rarely in contact at the base. The cardiac region has two submedian granulose elevations, but they are not higher than other regional prominences.

In another female example the carapace measures 63 by 140 mm. and the right chelipede is about 145 mm. in length. The interstices between the numerous bead-like granules are closely invested with plumose hairs, about 0·5 mm. in length; the branches are confined to the upper third, and the acute apical portion of each hair is unbranched. The frontal teeth are small, under 1 mm. in length. The cardiac and gastric tubercles are low, broad and studded with moderately large granules, a few of which are in contact at the base. There appear to be three characters which are fairly constant and sexual. In the male the chelipedes are greatly elongated; the granules on the carapace are few, small, distant and tend to become spiniform, and the antero-lateral teeth are broader and less acute than in the female. In the latter the chelipedes are short; the granules are numerous, large, bead-like and rarely more than their own diameter apart, at least on the transverse lines and the regional elevations.

The median frontal teeth vary so much that little reliance can be placed on them as a character; in fact, they are frequently absent altogether. Since the "Thetis" examples were examined I have seen some hundreds of specimens exhibited for sale in Sydney, and always made a point of inspecting as many as possible, with a view of determining the amount of variation in the frontal teeth. I have examined many specimens in which the teeth were wanting, and others in which they were represented by mere points or granules; in some cases only one tooth is developed, the other being absent, and the individual figured on Plate x. in the Fauna Japonica presents the same feature—the right submedian tooth is wanting.

The middle lobe of the upper orbital border has a compressed tooth at its outer angle, which is often acute, but this is not constant; it is frequently rounded like that on the inner angle.

GONIONEPTUNUS, *Ortmann.*

GONIONEPTUNUS SUBORNATUS, *Ortmann.*

Gonioneptunus subornatus, Ortmann, Die Decapoden-Krebse Strassburger Museums, pt. vi., in Zool. Jahrb., vii., 1893, p. 79, t. iii., fig. 9.

Portunus (*Charybdis*) *truncatus*, De Haan, Fauna Jap., Crust., 1835, p. 43, pl. xviii., fig. 2

Stations 37, 41.

A small male is here referred to this species; the carapace measures 17·5 by 24 mm.

The armature of the lateral borders and of the chelipedes agree with Ortmann's description, and the specimen in every character with De Haan's figure of the male.*

The front is divided into four lobes; the median pair are pretty close to each other, and are separated by a shallow v-shaped space; a wide, rounded, granular sinus divides the inner from the outer lobe, and a narrower, deep, smooth sinus exists between the latter and the inner angle of the orbit.

The carapace is clothed with short hairs, 0·6 mm. in length and 0·1 mm. or less apart; they are curled or directed towards the front; anteriorly they are simple; posteriorly they are more or less beset with short branchlets, which are confined to the upper third; the subterminal portion has a reddish band, and is unbranched.

The carapace bears four granulose elevations, almost in a transverse line: two are situated on the mesobranchial, and two submedian on the cardiac region; there are also a pair of short granular ridges posterior to the submedian interruptions in the main transverse ridges.

These granulose elevations are not mentioned either by De Haan or Ortmann. They are, however, plainly indicated in De Haan's figure.*

Since the above was written two other examples have been found—a male and a female; the carapace of the latter measures 15·5 by 23 mm.; that of the former 21 by 30 mm. (spines excluded); the specimens do not differ materially from the above. There is, however, one character worthy of note—the posterior margin of the carapace is slightly keeled, sinuated and minutely granular, and the lateral angles have a prominent, rounded, compressed lobe.

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* De Haan—Fauna Jap., Crust., 1835, pl. xviii., fig. 2.

Three examples were procured—two males and one female—between Botany and Wata Mooli, in 50 to 71 fathoms.

This species has not hitherto been met with outside of Japanese waters.

Family THALAMITIDÆ.

GONIOSOMA, *A. Milne-Edwards.*

GONIOSOMA MILES, *De Haan.*

Goniosoma miles, De Hann, Fauna Jap., Crust., 1835, p. 41, pl. xi., fig. 1. A. Milne-Edwards, Arch. Mus. Hist. Nat., x., 1861, p. 378.

Stations 21, 22, 24, 25.

The denticulations on the lower distal border of the sixth joint of the posterior legs are very variable in number. In the figure quoted above there is only one on each joint. In some of the "Thetis" specimens there are as many as three on each side, and in a young example, with a carapace measuring 20 by 30 mm., they are absent.

The spaces between the antero-lateral teeth are fringed with long hairs, and there is also a submarginal fringe commencing on the inferior base of the fifth spine and continued to a point over the origin of the second ambulatory leg.

Eight specimens were obtained off Newcastle, in from 21 to 48 fathoms.

Length of carapace of largest example ♂	...	47	mm.
Breadth „ „ „	...	61	„

Hitherto only recorded from Japan.

THALAMITA, *Latreille.*

THALAMITA PRYMNA, *Herbst.*

Thalamita prymna (Herbst), A. Milne-Edwards, Arch. Mus. Hist. Nat., x., 1861, p. 360. Miers, Chall. Rep., Zool., xvii., 1886, p. 197. De Mann, Journ. Linn. Soc., Zool., xxii., 1888, p. 75, pl. iv., figs. 5-6.

Station 14.

Two very small examples were obtained off Norah Head, in 25 to 32 fathoms.

PLATYONYCHUS, *Latreille.*

PLATYONYCHUS BIPUSTULOSUS, *H. Milne-Edwards.*

Platyonychus bipustulosus, H. Milne-Edwards, Hist. Nat. Crust., i., 1834, p. 437, pl. xvii., figs. 7-10.

Station 23.

Two specimens—one male and one female—obtained at Newcastle Bight, in 16 to 19 fathoms.

CATAMETOPA OR OCYPODIIDEA.

Family OCYPODIDÆ.

Subfamily CARCINOPLACINÆ.

PILUMNOPLAX, *Stimpson.*

PILUMNOPLAX ABYSSICOLA, *Miers.*

Pilumnoplax abyssicola, Miers, Chall. Rep., Zool., xvii., 1886, p. 228, pl. xix., fig. 2.

Station 37.

Six male examples are referred to this species. They agree in the main with the description and figure above quoted; the only point of difference is in the granulation of the carapace, which appears to be much finer than in the type. The words "very finely granulated" are applied to the chelipedes only; the carapace is referred to as being "everywhere granulated."

The granulation of the carapace is exceedingly fine and very peculiar; the granules are scarcely perceptible to the unaided eye; a one inch or two-thirds objective is requisite to see them

distinctly; they are of two kinds, and consist of numerous minute, round granules, and a series of flat, smooth, oblong, scale-like plates, about 0·04 mm. in their larger diameter. The scales are isolated, rarely in contact; the posterior margin is imbedded; the anterior is slightly elevated, and when the carapace is viewed at certain angles the edges of the scales appear like a series of short transverse lines.

The following measurements are taken from the larger example:—

Breadth of front	2·4 mm.
Length of carapace	6 „
Breadth of „	7 „
Length of right chelipede	9 „
„ „ merus	3 „
„ „ carpus	2·5 „
„ „ palm	4·2 „
Depth of „	2·8 „
Length of first right ambulatory leg ...	10 „
„ „ merus	4 „
„ „ carpus	2 „
„ „ propodus	2·5 „
„ „ dactylus	2·6 „
„ „ third ambulatory leg	11·4 „
„ „ fourth „ „	9 „

Obtained off Botany, in 50 to 52 fathoms. Previously recorded from Fiji, "off Matuku, Fiji Islands, in 315 fathoms."*

Subfamily OCYPODINÆ.

OCYPODA, *Fabricius.*

OCYPODA CORDIMANA, *Desmarest.*

Ocypoda cordimana, Desmarest, Consid. sur les Crust., 1825, p. 121. Kingsley, Proc. Acad. Nat. Sci. Phil., 1880, p. 185. Miers, Ann. Mag. Nat. Hist., (5), x., 1882, p. 387, pl. xvii., figs. 9-9*a*. De Mann, Notes Leyden Museum, iii., 1881, p. 248.

Two examples obtained at Botany Bay.

* Miers—Chall. Rep., Zool., xvii., 1886, p. 229.

Family GRAPSIDÆ.

Subfamily GRAPSINÆ.

GRAPSUS, *Lamarck.*

GRAPSUS VARIEGATUS, *Fabricius.*

Grapsus variegatus (Fabr.), H. Milne-Edwards, Hist. Nat. Crust., ii., 1837, p. 87.

One specimen of this extremely common shore crab was obtained at Port Stephens.

OXYSTOMATA OR LEUCOSIIDEA.

Family CALAPPIDÆ.

Subfamily CALAPPINÆ.

MURSIA, *Desmarest.*

MURSIA ARMATA, *De Haan.*

Mursia armata, De Haan, Fauna Jap., Crust., 1839, p. 73, pl. xix., f. 2.

Mursia curtispina, Miers, Chall. Rep., Zool., xvii., 1886, p. 291, pl. xxiv, fig. 2.

Stations 35, 41.

A male and a female of this species are in the collection.

The examples agree with Miers' description and figure in every character except two.

The lateral spines on the carapace are a little longer and are somewhat obliquely directed backwards, not straight as they are represented in both of the figures quoted above. The suborbital lobe or tooth is triangular in outline, and acute—not broad near the summit and thence suddenly narrowed to a subacute point, as it is depicted by Miers in figure 2*a*.

The carapace of the male measures 22 by 26 mm.; the lateral spines are about 7 mm. in length. In the female the carapace is 18 by 21 mm., and the lateral spines about 6 mm.

Port Hacking and Wata Mooli, in 22 to 71 fathoms.

Family LEUCOSIIDÆ.

Subfamily ILIINÆ.

EBALIA, *Leach.*

EBALIA TUBERCULOSA, *A. Milne-Edwards.*

Persephona tuberculosa, A. Milne-Edwards, Journ. Mus. Godeffroy, i., 4, 1873, p. 86.
Phlyxia granulosa, Haswell, Proc. Linn. Soc. N.S.W., iv., 1880, p. 54, pl. vi., fig. 3.
Ebalia tuberculosa, Miers, Chall. Rep., Zool., xvii., 1886, p. 306, pl. xxv., fig. 1.

Stations 13, 35, 37, 49, 57.

One hundred and sixty specimens of this species were obtained.

The carapace in the largest male measures 9 by 8·5 mm., and in the largest female 8 by 8 mm. In the former the chelæ are slightly longer than in the latter.

In a few of the adult females the tubercles on the carapace are low and obscure; in the males and young they are well developed, and agree with those depicted in Haswell's figure on plate 6, fig. 3.

The granules on the carapace are somewhat variable; in a few of the larger females they are quite flat; in the males and young they are often prominent and bead-like, especially on the front, hepatic, and the elevation portions of the branchial and central regions; on the antero-lateral margins they frequently become subspiniform.

Station	13 : 25	specimens,	off Cape Three Points,	41-50	fathoms.
„	35 : 20	„	off Port Hacking	22-38	„
„	37 : 50	„	off Botany Bay	50-52	„
„	49 : 20	„	off Port Kembla	63-75	„
„	57 : 45	„	off Wata Mooli	54-59	„

EBALIA (PHLYXIA) UNDECIMSPINOSA, *Kinahan.*

Ebalia (Phlyxia) undecimspinosa, Kinahan, var. *orbicularis*, Miers, Chall. Rep., Zool. xvii., 1886, p. 309.
? *Bellidilia serratocostatis*, Kinahan, Journ. Roy. Dublin Soc., i., 1858, p. 129.
? *Bellidilia undecimspinosa*, Kinahan, Journ. Roy. Dublin Soc., i., 1858, p. 128, pl. iii., f. 2, var.
Phlyxia orbicularis, Haswell, Proc. Linn. Soc. N.S.W., iv., 1880, p. 54, pl. vi., fig. 2.

Stations 22, 23, 50.

Seven examples—six males and one female.

The carapace in the largest male measures 31 by 29 mm., and the right chelipede is 85 mm. in length. In the female the carapace is 17·5 by 17 mm., and the right chelipede 25 mm. in length.

Newcastle Bight, in 26-40 fathoms; Shoalhaven Bight, in 15-18 fathoms.

EBALIA (PHLYXIA) CRASSIPES, *Bell.*

Ebalia (Phlyxia) crassipes, Bell, Trans. Linn. Soc., Zool., xxi., 1855, p. 304, pl. xxxiv., fig. 2. Haswell, Proc. Linn. Soc. N.S.W., iv., 1880, p. 53; Aust. Mus. Cat. v., Crust., 1882, p. 124. Miers, Zool. Coll. "Alert," 1884, p. 252; Chall. Rep., Zool., xvii., 1886, p. 307.

Station 35.

A small male example was obtained off Port Hacking, in 22-38 fathoms.

MEROCRYPTUS, *A. Milne-Edwards.*

MEROCRYPTUS LAMBRIFORMIS, *A. Milne-Edwards.*

Merocryptus lambriformis, A. Milne-Edwards, Journ. Mus. Godeffroy, i., 4, 1873, p. 85, pl. ii., fig. 1. Miers, Chall. Rep., Zool., xvii., 1886, p. 320.

Stations 5, 35.

Two examples only—a young male and an adult female. The carapace in the latter measures 12 mm. in length, and 11 mm. in breadth in front of the lateral processes.

Off Narrabine, in 64-84 fathoms; off Port Hacking, in 22-38 fathoms.

ANOMURA.

DROMIDEA.

Family DROMIDÆ.

CRYPTODROMIA, *Stimpson.*

CRYPTODROMIA LATERALIS, *Gray.*

Cryptodromia lateralis, Gray, Zool. Miscell., 1847, p. 40. Stimpson, Proc. Acad. Nat. Sci. Phil., 1858, p. 77. Henderson, Chall. Rep., Zool., xxvii., 1888, p. 5.

Station 44.

A solitary example of this species was obtained off Coogee, in 49 to 50 fathoms.

Family PARATYMOLIDÆ.

PARATYMOLUS, *Miers.*

PARATYMOLUS LATIPES, *Haswell.*

Paratymolus latipes, Haswell, Ann. Mag. Nat. Hist., (5), v., 1880, p. 303, pl. xvi., figs. 3-5; Aust. Mus. Cat. v., Crust., 1882, p. 143.

Stations 28 and 33.

Six specimens, including one adult female with ova.

Newcastle Bight and off Manning River, in 22 to 27 fathoms.

Family HOMOLIDÆ.

HOMOLA, *Leach.*

HOMOLA ORIENTALIS, *Henderson.*

Homola orientalis, Henderson, Chall. Rep., Zool., xxvii., 1888, p. 19, pl. ii., fig. 1.

Stations 24, 25.

Two specimens—a male and a female—were obtained; one at Station 24, in 21-48 fathoms, and the other at Station 25, in

42-48 fathoms. The female example agrees with Henderson's description generally. The nine gastric prominences are, however, broadly conical and subspiniform; not "rounded tubercular processes."

The male differs from the female in many important characters, which may be enumerated as follows:—

The gastric and first antero-lateral spines are larger; they arise from broader bases and taper gradually to acute points. The spines on the inner border of the meral joint of the chelipedes are almost equal in size to those on the outer and upper, and the internal and external surfaces are more or less studded with subspiniform granules. The chelæ are much larger; the fingers proportionately shorter, stouter and marked on both sides with numerous deep pits, from which arise tufts of long yellowish setæ.

The hand bears numerous rounded and some spiniform granules; the upper border of the palm has a narrow irregular band of small rounded granules, and there is a single row of nine larger ones on its internal aspect; the internal surface has three longitudinal rows—one central and two subcentral, and rather nearer the centre than the borders; the external surface has also three short rows, which are confined to the proximal third; the median row is the most distinct, and extends a little beyond the others. The whole of the lower border is covered with a broad band of spiniform granules; those on the inner margin are larger, seriately disposed, and about ten in number. The upper borders of the meral joints of the first three pairs of ambulatory legs are armed with from eight to ten strong curved spines; the lower borders carry from six to nine, which are shorter and less curved than those on the upper.

The anterior angle of the merus joint of the external maxillipedes bears a few small spinules on its distal third; they commence on a level with the summit of the rounded lobe on the external border.

The "Challenger" examples were obtained at Ki Island, at a depth of 140 fathoms, and off Zebu, Philippine Islands, in 95 fathoms.

Length of carapace of female	... ...	30 mm.
Breadth of ,, ,,	... ...	23 ,,
Length of right chelipede	... ...	50 ,,
,, ,, merus	... ...	15 ,,
,, ,, carpus	... ...	9·5 ,,
,, ,, propodus	... ...	21·5 ,,
Depth of palm...	... ...	7 ,,
Length of fourth right leg	... ...	72 ,,
,, ,, merus	... ...	22·5 ,,

Length of carpus	... 14	mm.
,, ,, propodus	... 21	,,
,, ,, tarsus	... 13·5	,,
Length of carapace of male	... 35	,,
Breadth of ,, ,, ...	... 27	,,
Length of right chelipede	... 88	,,
,, ,, merus	... 25	,,
,, ,, carpus	... 18	,,
,, ,, propodus	... 39	,,
Depth of palm	... 14	,,
Length of fourth right leg	... 92	,,
,, ,, merus	... 28	,,
,, ,, carpus	... 19	,,
,, ,, propodus	... 24	,,
,, ,, tarsus	... 17·5	,,
Length of largest gastric spine ...	... 3·5	,,
,, ,, smallest ,, ...	... 2	,,
,, ,, first antero-lateral spine ...	. . 5·5	,,
,, ,, eye peduncle	... 14	,,

LATREILLIA, *Roux.*

LATREILLIA AUSTRALIENSIS, *Henderson.*

Latreillia australiensis, Henderson, Chall. Rep., Zool., xxvii., 1888, p. 24, pl. ii., fig. 24.

Stations 37, 38, 39, 40, 41, 42, 48.

Thirty-five examples were obtained off Botany, in 50 to 78 fathoms, off Wollongong, in 55 to 56 fathoms.

RANINIDEA.

Family RANINIDÆ.

LYREIDUS, *De Haan.*

LYREIDUS TRIDENTATUS, *De Haan.*

Lyreidus tridentatus, De Haan, Fauna Jap., Crust., 1841, p. 140, pl. xxxv., fig. 6.

Stations 22, 25, 57.

There is one adult male in which the carapace measures 42 mm in length and 25 mm. in breadth at the lateral spines.

Three specimens were obtained at Newcastle Bight and Wata Mooli, in 26 to 59 fathoms.

PAGURIDEA.

Section PAGURODEA.

LAMINIBRANCHIATA.

Family PAGURIDÆ.

DIOGENES, *Dana.*

DIOGENES MILES (*Fabr.*), *De Mann.*

Diogenes miles, De Mann, Jour. Linn. Soc., Zool., xxii., 1888, p. 232, pl. xv., figs. 7-9.

Station 50.

There are five examples which agree in every character with the figures and description quoted above.

The specimens exhibit some trace of the original colour; the basal halves of the propodal and tarsal joints of the ambulatory legs are of a reddish-brown tint; the distal portions are creamy-white; the tarsi change to a slaty-grey towards the extremities.

Total length about 40 mm.; length of body, 30 mm. Shoalhaven Bight, in 15 to 18 fathoms.

Two other specimens are in the Museum collection from Jervis Bay. The form named *Diogenes merguiensis*, De Mann, is not represented in the Museum collection.

PAGURUS, *Fabricius.*

PAGURUS STRIATUS, *Latreille.*

Pagurus striatus, Latr., Hist. Nat. Crust., vi., 1802-1805, p. 163. De Haan, Fauna Jap., Crust., 1849, p. 206, pl. 49, fig. 1.

Stations 9, 12, 13, 22, 25.

About thirty examples of this species were obtained.

The following measurements are taken from an adult male:—

Length of body, from front to end of telson ..	150 mm.
,, ,, carapace in the mesial line	55 ,,

Width between the lateral denticles of the front...	12 mm.
Total width of frontal margin	21 ,,
Length of ocular peduncle	15 ,,
,, ,, peduncle of outer antenna	19 ,,
,, ,, acicle	11 ,,
,, ,, left chelipede	85 ,,
,, ,, third right leg	122 ,,

The colour in alcohol is as follows:—Scales and bases of spines on the upper surfaces of limbs, mauve; lower surfaces and tips of spines, red; setæ fringing the scales, bright yellow; inner distal surface of palm and the fingers, vermilion; the merus-joints with one and the eye stalks with two bands of the same tint. A similarly coloured oblong calcified plate is present in the membrane of the mero-carpal joints of the chelipedes; the plate is also present in the second and third pairs of legs, but it is much less in size and uncoloured.

Cape Three Points and Newcastle Bight, in 23 to 48 fathoms.

CLIBANARIUS, *Dana.*

CLIBANARIUS STRIGIMANUS, *White.*

Clibanarius strigimanus, White, Proc. Zool. Soc., 1847, p. 121; Ann. Mag. Nat. Hist., (2), i., 1848, p. 224. Miers, Zool. Ereb. & Terr., Crust., 1874, p. 3, pl. xi., fig. 4. Henderson, Chall. Rep., Zool., xxvii., 1888, p. 60.

Stations 12, 13, 25.

Twenty-one large examples of this well-marked species were obtained at Cape Three Points and off Newcastle, 23 to 50 fathoms. The largest adult male yields the following measurements:—

Length of carapace	73 mm.
Width of frontal margin	26 ,,
Length of ocular peduncle	22 ,,
,, peduncle of outer antenna ...	23 ,,
,, acicle	14 ,,
,, peduncle of inner antenna ...	30 ,,
,, left chelipede	100 ,,
,, third right leg	175 ,,

The anterior portion of the carapace is as broad as long, the surface is rather uneven and marked by numerous shallow subcircular pits, from 1 to 2 mm. in diameter, and the sides of the carapace bear a few tufts of setæ. The front has a thickened margin,

which extends from the obtuse rostral tooth to the small lateral denticles, opposite the inner bases of the outer antennæ.

Eye stalks with several tufts of hairs on their upper surfaces; the subapical and basal tufts are much larger than the intermediate ones.

The basal joint of the second antenna has a small spine at its outer distal angle; the acicle is compressed at the base and bordered on each side by three or four spinules; the superior surface and the outer margin bear some tufted hairs; the inferior surface is smooth, glabrous, and concave near the base.

The third joint of the external maxillipedes is armed on its inner acute margin with eighteen black denticles, subequal in size and in distance apart.

Meral joints of the first three pairs of legs spinose on their lower borders. Upper borders of the second and third with a few spinules disposed in short transverse rows and mixed with long hairs. The first has the upper distal surface and the margin strongly spinose. The succeeding joints are more or less covered on their upper and external surfaces with spines having a calcareous base and a corneous apex; as the distal extremities are approached the corneous portion becomes more conspicuous and forms more than half of the spine.

The inner surface of the hand and mobile finger has some of the spines elongated, appressed throughout, and disposed side by side longitudinally, forming seven or more transverse rows. These modified spines constitute a series of corrugations, which when rubbed together produce a sound like that made by passing the point of a penknife across the teeth of a comb.

It is possible that these peculiar processes may be used for other purposes than that of producing sound; they may possibly be used for holding objects between the hands or to prevent the latter from being forcibly moved either up or down when attacked by an enemy. The slightest pressure brings the two corrugated surfaces together, and they interlock so neatly that it requires considerable force to raise or depress the claws.

Mr. Waite informs me that when turned out on deck the Hermit Crabs, both *Pagurus striatus* and *Clibanarius strigimanus*, would extend their bodies and limbs far out of their shells and walk about. If, however, the shell or a limb was touched, or even if a hand was passed within range of their vision, they would instantly withdraw with a snap, their limbs rattling like old bones; for the space of a few seconds they then produced a loud stridulating sound; when recovered from their alarm they would recommence their peregrinations.

EUPAGURUS, *Brandt.*

EUPAGURUS LACERTOSUS, var. NANA, *Henderson,*

Eupagurus lacertosus, var. *nana*, Henderson, Chall. Rep., Zool., xxvii., 1888, p. 64, pl. vii., fig. 1.

Stations 2, 9, 28, 33, 35, 37.

One hundred and ten examples of this species were obtained, the range extending from Manning River to Botany Bay, and the depth from 22 to 52 fathoms.

PAGURISTES, *Dana.*

PAGURISTES TUBERCULATUS, sp.nov.

(Figs. 11, 11A.)

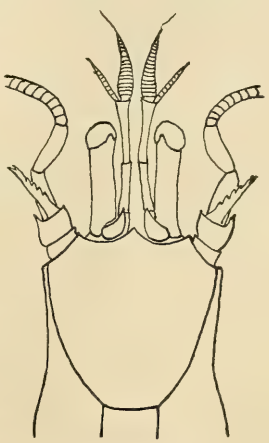
Stations 28, 33.

Anterior region of carapace slightly rugose, front bisinuate with three equal but little prominent teeth; a narrow thickened border extends from the apex of the median tooth, on either to the hinder base of the lateral ones. Ocular scales acute, 0·35 mm. long, 0·15 mm. wide, and 0·1 mm. apart.

Ocular peduncles slender, thicker at the base than at the summit, slightly constricted in the middle, with a single line of setæ on the upper surface. Length 1·4 mm., diameter 0·35 mm.

Basal joints of first antennæ 0·4 mm. in length, second joint 0·5 mm., third joint 0·8 mm., larger flagellum 1 mm. and smaller 0·6 mm.

First exposed joints of the second antennæ stout, 0·4 mm. in length, with a single spine on its inner and three on its outer prolongation; second joint slender, 0·35 mm. in length; third joint, 0·6 mm.



Frontal Region x 8.
Fig. 11.

Flagellum short, 2·8 mm. in length, consisting of sixteen articuli; from the lower third the joints gradually increase in

length to the summit. Each joint bears on its upper margin three or more long curved setæ. The setæ are branched on one side, giving rise to two short hairs equal in length; they are opposite below; but become alternate towards the summit.

Antennal acicle slender, 0·65 mm. in length, with seven or eight spinules on the inner aspect of the upper surface, and an unequal pair at the apex.

Chelipedes in adult male unequal, the right being much the smaller. The left chelipede is 10 mm. in length. The merus joint is trigonus. The inferior border is armed with about ten spines; the distal six are rather elongate, strong and curved. Superior border with a line of seven spinules, three of which are situated anterior to the slight transverse groove. The external border bears a series of subspiniform granules and terminates distally in an obtuse denticle. Superior distal margin with three or four small spinules. Lower surface setose, external granulose, inner smooth, polished and marked with two transverse red blotches near the distal end and a cuneate impression proximally.

Left Chelipede x 8.
Fig. 11a.

Carpus rounded, except the superior border, which is slightly angular and bears seven spinules. The superior and external surfaces are granulose; a few of the granules are subspiniform and shortly seriate. The lower, inner and inferior surfaces are smooth. Hand 4 mm. long, its greater diameter 2 mm. and the lesser 1·8 mm. Inner surface of palm with a few scale-like granules from which arise some short, stiff setæ.

External surface and both borders of the palm more or less covered with rounded granules disposed as follow:—A close double row on the upper border and another rather indistinct on the lower; the latter widens out proximally and extends upwards to the middle of the hinder margin of the palm; here commences a ridge which is continued to the tip of the slightly bent lower finger; the ridge bears a series of tubercles, each of which is surmounted by two or more granules; another similar row of tubercles is present in a line with the inter-digital space.

Fingers acute, crossed and calcareous at the tips, meeting along their edges when closed; external surfaces sulcate, outer aspect

of inner edges lined with small granules, the inner sides slightly hairy; mobile finger smooth internally ; upper border with about fourteen rather high, obtuse granules and a few setæ.

Right chelipede about 6 mm. long ; merus joint similar to that of the left; carpus with five strong spinules on the upper border; hand very short, the palm has four closely placed spinules on its upper border; the lower border and the inner surface rounded, with a few scales and some short setæ; external surface and fingers clothed with long hairs; fingers acute, corneous at the tips and slightly setose.

Ambulatory legs of the right side unequal, the first 8·5 mm. in length, the second 10 mm.; ischium joint of the first leg wider than long, fringed with hairs on the upper and lower distal borders ; merus joint more than twice as long as deep; the upper border bears about fourteen curved spinules ; propodus equal to the merus in length, subcylindrical, but laterally sulcated distally; upper border with twelve spinules, slightly larger than those on the preceding joint and inclined forwards.

Tarsus stout, slightly curved, compressed and grooved at the sides to within a short distance of the horny claw. The second leg differs from the first in having the tarsus and ischium joints longer; the latter is not quite twice as long as deep. The spinules are also smaller in size and number.

Ambulatory legs of the left side equal in length (8·5 mm.), the first similar to its fellow on the right side. The propodal joint of the second has a deep longitudinal sulcus on the external surface; it is bounded below by a prominent crest, which bears about sixteen subspiniform granules ; the lower border is armed with ten or twelve spinules.

Tarsus sulcate and feebly carinate externally ; there are a few spinules on the outer angle of the upper border and many on the lower, disposed in two rows ; the inner row is continuous, the outer terminates at the distal third.

Fourth pair of legs stout ; the rasp is elongate and subtriangular in shape, with about five scales in a row at its broadest point.

Fifth pair of legs slender, fold or bent upwards over the hinder margin of the carapace.

First pair of abdominal appendages short, stout, slightly curved and bilobate on the inner aspect of their apices; the outer arcuate distal edges are armed with linear rasps, composed of numerous small curved spinules ; there is a tuft of simple setæ on the inner side of the base of each appendage, and numerous simple hairs on the margins of the apical lobes.

Second pair of appendages equal and slender, first joint as long as the two following combined, third joint shorter than the second, thickly covered with branched setæ on its distal half.

Third appendage uniramous, margined with plumose hairs and bounded on each side at the base by a linear series of long much branched setæ.

Fourth and fifth similar to the preceding, except that there is only one basal group of setæ.

Penultimate segment of the abdomen with a submedian T-shaped impression; appendages very unequal, the basal joint on the left side tumid and grooved. Lateral margins of telson deeply incised and lobate about the middle; posterior margin strongly emarginate, with two unequal lobes; the right lobe is small and bears a few setæ and two or three spinules; the left is large and is bordered by some setæ and six or more strong spinules.

The females are somewhat smaller than the males, otherwise they do not differ from the latter except in the usual sexual characters.

The appendages of the first abdominal segment are short and two-jointed; the first is rather stout and equal in length to the second; the latter is strongly setose distally and similar in shape to the terminal joint of the second appendage in the male.

The second, third and fourth appendages are biramous, the fifth is uniramous.

Colour.—Outer antennæ and walking legs annulated with narrow reddish bands. Chelae bright red, tips of fingers of larger hand white, body and limbs scantily clothed with brownish hairs.

Total length of body from tip of rostrum to end of telson 14 mm.

Numerous examples, including many ova-bearing females, were obtained at Stations 28 and 33.

Sixty-three specimens of this interesting species were obtained off Manning River and Newcastle Bight, in 22 to 27 fathoms.

SYMPAGURUS, *S. I. Smith.*

SYMPAGURUS DIOGENES, sp. nov.

(Plate xxxiv., fig. 3.)

Stations 35, 48.

The anterior region of the carapace is slightly areolate; the calcification is limited to the sides and the front; the latter has

a broad, rounded, central lobe 3 mm. wide; the lobe is marked by a short rounded median ridge; its sides are slightly thickened, and it is bounded on each side by a sinus and a small obtuse tooth; from the latter the outer frontal margin slopes away obliquely backwards to the somewhat rounded angle. The upper surface is smooth; there is a pair of submedian tufts of setæ situated a short distance from the frontal margin, and a few other more or less linear tufts which follow the regional depressions, and a well marked submedian pair are present immediately posterior to the cervical groove.

Eye peduncles short, stout, sensibly constricted in the middle, and dilated towards the summit, with a single longitudinal row of hairs on the inner aspect of the superior surface. Cornea subreniform when viewed from above. A small margined shield-shaped plate is situated between the inner bases of the ocular peduncles; its anterior margin is concealed beneath a low, broad, convex disc, which is surmounted by a short spine, about 0·07 mm. in length.

Ocular scales triangular, each with a tapering, acute, simple and inwardly inclined spinule.

First antennæ twice as long as the eye stalks; first joint stout, shorter than the second; third joint equal in length to the two preceding.

Peduncles of second antennæ a little longer than the eye stalks; first exposed joint with a small spine on its inner distal extremity and a much larger one on the outer; the latter bears one or two spinules; second joint equal in length to the first, moderately stout and somewhat swollen in the middle; a small spinule projects from the superior distal transverse margin; third joint the longest, but not equal to the first and second combined.

Flagellum about twice the length of the carapace, beset with a few long and numerous short setæ. Antennal acicle somewhat curved, nearly reaching to the level of the eyes, armed on the inner convex side with nine spinules and a few long setæ. External maxillipedes elongate and subpediform; the ischium joints have their margins carinate and denticulate; the denticles are about twelve in number, and consist of an alternating series of larger and of smaller acute teeth, all being more or less tinged with yellow at the tips.

The right chelipede of the adult female has the outer aspect of the ischium joint very short; the internal border is longer than the joint is wide; it bears a single row of setæ, a few seriate granules, and is somewhat subcarinate. The merus joint is trigonus, narrow proximally, and gradually increasing in diameter to the summit; the external and inferior surfaces are minutely

granulose; the granules are more or less connected at their bases by reticulated white lines, and generally the tip of each granule bears a few very short hairs; the internal surface has a subcordiform impression, the inner superior portion of which is limited by a bright red line. Inferior border evenly rounded, the superior angular, smooth; the latter has a small spinule at its distal extremity, and the former terminates in a small white rounded lobe; the internal border is strongly carinate, especially towards the apex; the basal half is straight, and carries two rows of granules; the distal half is curved. and bears a series of about twelve small denticles; there is a well-marked transverse groove on the superior surface near the distal margin.

Carpus subtriangulate, twice as wide distally as proximally; inner extremities excavated and adapted to the shape of the preceding and following joints; surfaces more or less granulose; superior border broadly rounded, sloping away on the left to short prominent inner border, and on the right to the central longitudinal ridge on the outer surface; inferior border rounded to within a short distance of its extremity, where it becomes suddenly angular, and terminates in an acute point. The outer distal margin presents a smooth narrow ridge, which commences at the lower articular condyle, and is continued to within a short distance of the upper one; the lower half of the ridge is bounded posteriorly by a shallow groove, the upper is hidden beneath a denticulated crest, the latter is a continuation of the granular ridge on the external surface. Another crest extends from the inner distal angle to the upper articular condyle; behind the latter there is a short longitudinal depression which marks the inner limits of the crests.

Hand compressed, its depth at the obliquely truncated extremity is about twice the transverse diameter of the central region of the palm. Lower border denticulate, acutely keeled, evenly curved throughout, the curvature tending upwards and inwards as the extremity of the ill-defined lower finger is approached. Upper border broad, rounded and closely granulose, with a short transverse, minutely denticulated crest at its distal extremity, and a longitudinal ridge on its outer aspect; the ridge bears a series of small subspiniform granules, and is bounded below by a shallow groove. Outer and inner surfaces of palm longitudinally convex, both closely granulose; the granules on the inner surface are smaller than those on the outer, and proximally they are more or less reticulately disposed; there is an indistinct longitudinal row of granules on the central region of the external surface, and at the distal margin and near the lower border the granules become subspiniform.

Superior border of mobile finger arcuate, keeled and obtusely denticulate; outer surface evenly rounded with numerous flattened

granules; inner surface finely granulose, and longitudinally excavated in its upper half. Fingers acute, crossed and calcareous at the tips, their inner edges unevenly denticulate and almost in contact throughout when closed. The mobile finger is subvertical and nearly at right angles to the upper border when closed, its length being nearly equal to the truncated extremities of the palm and the ill-defined lower finger.

Left chelipede small, slender; merus joint compressed, smooth; superior border acute, with a single line of setæ; outer aspect of inferior border with a short denticulated crest. Carpus elongate, a little compressed proximally, becoming subtrigonus distally; inner surface smooth, slightly setose, outer distally granulose and setose; lower border rounded, upper angular, with a line of subspiniform granules and a small spine at its distal extremity; there is also a small spine on the lower half of the distal margin.

Hand compressed, equal to the carpus in length, breadth and depth; palm as long as the mobile finger; the inner surface is smooth and has a ridge-like elevation which is continuous with the inner angular side of the lower finger; external surface longitudinally but indistinctly bisulcate, with three or four rows of granules, of which those situated on the external aspect of the upper surface are the largest.

Fingers long, acute and corneous at the tips; external surfaces rounded, punctate and slightly setose, internal surfaces longitudinally excavated to the acute inner edges; the lower finger is slightly bent downwards and inclined inwards towards the extremity.

Ambulatory legs moderately elongate, subequal, smooth, compressed and sparsely hairy; the hairs are short, and mostly confined to the upper borders of the joints. The merus joint is equal in length to the propodus, and a little longer than the carpus; the superior border of the latter terminates in a small spinule.

Tarsus as long as the carpus and propodus combined, curved, compressed and laterally grooved at the base; upper and lower external borders punctate and shortly setose.

The fourth pair of legs is subchelate; the rasp consists of a linear series of fifteen scales, occupying about four-fifths of the distal margin; all the joints are more or less fringed with long curved hairs.

The fifth pair of legs is also similarly fringed with long hairs; the rasp is oblong in shape, and there are about six scales in each row.

There is only one external genital opening—it is situated on the coxal joint of the third left leg.

Abdomen longer than the carapace; somites very distinct; the last two segments have their dorsal walls well calcified.

The first segment of the abdomen bears a pair of slender genital appendages; they are slightly compressed, acute at their apices, and measure about 3 mm. in length. The second, third, fourth and fifth abdominal appendages of the left side biramous; the branch on the fifth is very short, measuring about 2 mm. in length; sixth pair of appendages very unequal, the left one being much the larger. Telson slightly unequal, with a smooth rounded margin.

The male has a pair of genital appendages on the first abdominal segment; they are equal in length to those occurring in the female, but differ in shape towards their extremities, and are lancet-like and longitudinally channelled.

The second segment has a pair of subequal uniramous appendages; the three following segments have each a single biramous appendage on the left side.

General colour pale cream; eye peduncles light brown; cornea blackish-brown; proximal portion of the carpal joints of the first three pairs of legs with a narrow, transverse, bright red band; each band is more or less interrupted on the lower surface.

Chelipedes of a reddish tint, the colour fading to cream towards the extremities.

Proximal lamellæ of the gills oblong; inner apical margin evenly curved and trending outwards; outer border with a slight angular sinus, situated at about one diameter from the summit. As the distal end of the gill plume is approached the sinus gradually diminishes in size, and the outer apical border becomes obliquely truncated; the last series of distal plumes—about twelve rapidly diminishing pairs—are simple rounded filaments.

This species is very closely allied to *Sympagurus arcuatus*, Edwards and Bouvier,* from which it differs in its larger size, in the shape of the gill lamellæ, in the granulation and shape of the larger hand, which is more transversely truncated at the extremity, and finally in having a small spine at the anterior end of the ocular segment, after the manner of Diogenes, hence the specific name.

Length of body from rostrum to tip of telson	70	mm.
,, ,, carapace	17	,,
Width of front	8	,,
Length of right ocular peduncle	5	,,
Diameter ,, ,, ,, at base ...	1·8	,,

* Mem. Mus. Comp. Zool., xiv., 3, 1893, p. 67, pl. v., figs. 21-28.

Longer diameter of cornea	3	mm.
Length of right chelipede along the bent outer surface	40	„
Length of merus	7·5	„
„ „ carpus	11	„
„ „ lower border of palm and finger ...	17	„
Depth of palm	13	„
Transverse diameter of palm...	6	„
Length of mobile finger	11	„
Length of second right leg	43	„

Two specimens—an adult female from Station 35, off Port Hacking, in 22 to 38 fathoms—and a young male from Station 48 off Wollongong, in 55-56 fathoms.

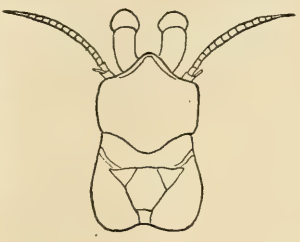
GLAUCOTHOË, *H. Milne-Edwards.*

GLAUCOTHOË HEXAGONATA, sp. nov.

(Figs. 12, 12*a*.)

Station 57.

Anterior region of the carapace rather convex; rostrum prominent, broadly triangular in outline; the subacute apex is slightly bent downwards, and projects between the bases of the ocular peduncles; the upper surface has a short median ridge bounded on each side by a shallow groove; the sides are thin, somewhat elevated, and adapted to the bases of the eye-stalks. Posterior region of carapace a little broader and about equal in length to the anterior portion.



Carapace x 8.
Fig. 12.

Cervical groove well marked; the cardiac area is rather broad, distinctly circumscribed and six-sided; at each lateral angle is situated a V-shaped plate with the base directed posteriorly.

Ocular peduncles 0·8 mm. long and 0·4 mm. in diameter; they are slightly curved, and a little narrower at the base than at the summit; cornea round, black, becoming greenish-blue at the junction with the peduncles. Peduncle and flagellum of first antenna about 1 mm. long; joints short, stoutish and subequal; smaller flagellum with three or four articuli, each tipped with a

few short hairs; larger flagellum consisting of six articuli, the first stout, glabrous and a little broader than long; the second and third subequal, twice as long as broad, each of which bears a dense tuft of long hairs; fifth joint narrow, and equal in length to the four preceding; sixth short, with an apical tuft of long setæ.

Peduncle of second antenna 0·7 mm. long; first joint stout, with a slight lobe on its inner distal angle.

Acicle subacute, three times as long as broad, reaching to the end of the short second joint, it bears a short spinule at its outer apical angle; third joint not quite equal to the first and second combined. Flagellum 1·6 mm. long, with twelve articuli, each of which bears four or five short hairs at the apex.

Chelipedes equal, the left 2·5 mm. long. Merus joint compressed, one-third longer than deep. Upper border carinate, armed with six very faint denticles, from which arise an equal number of short setæ; inferior border similar to the upper but shorter; outer border angular; lateral and inferior surfaces smooth.

LEFT CHELIPEDE x 8. Fig. 12*a*.

Carpus short, a little compressed, about equal in length to the depth of the merus; upper border arched and subacute; lower border extremely short; outer distal margin with a slightly thickened rim, which is bounded posteriorly by a narrow groove; surfaces with a few scattered hairs.

Hand short, compressed, longer than the merus; palm deeper than long; upper and lower borders rounded, equal in length; both, as well as the outer surface and the upper distal margin, bearing a few short setiferous denticles.

Fingers longer than the palm, slight, hairy and corneous at the tips; the upper is acute and bears two small denticles on its inner margin; the lower is obtuse and somewhat excavated, its inner margin has one large denticle situated about the middle.

Second pair of legs perceptibly stouter and longer than the third, about 3·9 mm. in length; ischium joint twice as long as broad; merus compressed, twice as long as the ischium; upper and lower borders thin, with a few scattered hairs; carpus deeper than wide, its lower border equal to the ischium in length; upper border rounded, with a faint transverse impression near the distal end, from which arise several stiff setæ; propodus equal to the tarsus, borders rounded, external surface with three or four rather ill-defined ridges disposed longitudinally.

Tarsus a little curved and compressed, tapering from the proximal third to the acute, dark brown, horny claw, lower border armed with five or six spinules which are strongly inclined forward towards the extremity. The third leg differs from the second in having the ischium joint broader than long.

Fourth leg 1·4 mm. long; the borders are sparsely setiferous; ischium and merus joints subequal in length; propodal rasp as long as the tarsus, oblong, with three rows of scales.

Fifth pair of legs slender, 1·6 mm. long; merus equal in length to the three following joints; rasp, small, interrupted; propodus with a series of six rasp-like spinules situated on the anterior distal border.

Pleon strongly convex, the segments rounded and distinct, the first narrow, the second, third and fourth equal, longer than the fifth; each postero-lateral angle has a rounded lobe, which is slightly notched at its origin anteriorly.

Pleopods unequally biramous, the outer and larger branch with eleven long plumose setæ, confined to the distal half of the margin; inner ramus slender, glabrous, about half as long as the outer, with a rudimentary rasp consisting of a line of four curved scales, equal in size and in distance apart, they are situated on the outer margin near the distal extremity.

Uropods rather large, equal; protopodite with a small spine on the inner distal angle; outer ramus nearly as long as the width of the telson, subtriangular in outline and margined throughout with plumose hairs; outer border nearly straight, distal obliquely truncated, with three rows of oval scales; inner ramus as broad as long, margin setose, distal border rounded with two or three rows of scales.

Telson subquadrate, the sides nearly straight, with six simple hairs, three on each margin about the middle; lateral angles rounded, distal margin slightly convex, with twelve long plumose setæ; they are confined to the inner two-fourths of the border, and the outer ones are more remote from each other than those nearer the centre; upper surface marked anteriorly with numerous fine transverse striations; at about the distal fourth the striæ bend towards the extremity and are longitudinally disposed in the central region.

Total length of body	7	mm.
Length of carapace in the median line ...	2·2	,,

A solitary example was obtained off Wata Mooli, in 54-59 fathoms.

GLAUCOTHOË CARINATA, *Henderson.*

Glaucothoë carinata, Henderson, Chall. Rep., Zool., xxvii., 1888, p. 84, pl. ix., fig. 1.

Station 33.

A single male example which agrees with the description in every character except one, *i.e.*, the telson is truncated and does not present "a slight median emargination."

The specimen exhibits a few characters worth recording. The frontal process is bordered by a distinct and slightly thickened margin, the lateral ridges are, like the median ridge, rounded along their summits and are a little longer, but not quite so wide; the lateral depressions bounding the median ridge bifurcate at their posterior half; the branches from thence follow the contour of the ridges to their terminations.

Each dactylus of the ambulatory legs has at the lower proximal base a broad, transverse, convex prominence, the anterior margin of which is rounded, the posterior neatly emarginate; the outer angle is prolonged and extends upwards as a gradually narrowing ridge to the margin of the upper border. The whole surface of this peculiar prominence is minutely scaly, roughened and quite unlike the adjoining surface, which is smooth.

The lower distal extremity of the propodal joint has a slightly elevated rim, which is semicircular in outline, swollen, and bounded behind by a shallow groove; it has an elongate lobe on the outer side, which is, when the tarsi are drawn back—closely applied to the corresponding lobe on the outer side of the tarsus; the anterior concave surface of the rim and its lobe are roughened, scaly, and adapted to the scaly prominence on the base of the tarsus. The two roughened surfaces when superposed would have a brake-like effect, and form a kind of locking joint.

Judging by the appearance of the body and limbs, it seems highly probable that this species lives in the shells of *Dentalium* or shells of narrow dimensions; the second and third legs are parallel with and closely applied to the sides of the chelipedes. If such be the habitat, the function of the specially modified tarso-propodal joint may be easily explained. I venture to suggest that the function is opercular and that the tarsi are used to protect the entrance of the shell from would-be intruders. It appears probable that when the tarsi are drawn back and at right angles to the propodi—beyond which angle they cannot be forced without breaking—that the two roughened surfaces are brought into close contact and the joints locked; the claws would then form a kind of rigid four-railed fence across the aperture of the shell. The chelipedes are of such a length that the long, narrow fingers could be projected between the tarsi and give a warning nip to any organism attacking from without. The tarsal joint is slightly curved and about 2·5 mm. long; the lower border is armed with two or three strong calcified spines 0·1 to 0·2 mm. long and a few stiff setæ, and terminates in a stoutish black horny claw.

Shorter ramus of pleopoda with a rudimentary rasp of four curved scales.

The rami of the uropods have the margins more or less subserrate, each serration tipped with a long plumose hair; the outer

basal third of the inner ramus is, however, smooth and almost glabrous.

The external distal third of the outer ramus is armed with about eighteen oval rasp-like teeth; there is also a row of fifteen occupying more than half of the outer distal margin of the inner ramus. The inner angle of the protopodite is produced into a strong spine. The lateral margins of the telson are slightly thickened, smooth, with a few short setæ; the distal margin is truncate, without any trace of emargination, and bears fourteen long plumose hairs.

Total length	20 mm.
Length of body	11 „
„ right chelipede	8 „
„ third right leg	11 „

Off Newcastle Bight, 24-27 fathoms.

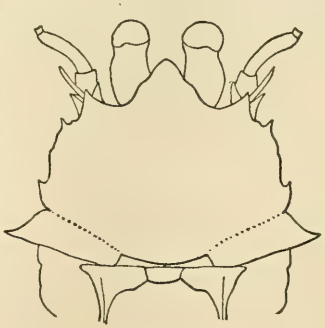
PORCELLANO-PAGURUS, *Filhol.*

PORCELLANO-PAGURUS TRIDENTATUS, sp.nov.

(Figs. 13, 13*a*, 13*b*.)

Station 57.

Carapace 7 mm. long and 5 mm. broad, smooth, glossy, slightly uneven and transversely convex, clothed with a few scattered tufts of short setæ, posterior region imperfectly calcified. Frontal margin smooth, a little thickened, with two wide semicircular emarginations and three prominent denticles; the lateral teeth are acute and directed forwards; the straight outer margin measures 0·6 mm. and the base 0·4 mm.; the rostral tooth is 1 mm. wide at the base and 0·9 mm. long; it is abruptly narrowed at its distal third and subacute at the apex.



Carapace x 6.
Fig. 13.

The sides of the carapace bear two spines; the first is situated on the anterior surface of a rounded eminence, and is about its own length from the base of the external frontal tooth. The second spine is smaller than the first and arises from the anterior

angle of a short prominence immediately in front of the well marked cervical groove; the latter is bounded posteriorly by two subtriangular lamellæ, which are separated mesially by a space equal to their length; each lamella has the anterior margin depressed and follows the contour of the groove; the posterior margin is elevated, ridge-like, slightly sinuous, and terminates externally in a prominent triangular denticle, bearing one or two spinules and a few hairs.

Ocular peduncles exceeding the rostral spine by about half their length, short, stout, 1·5 mm. long and 0.75 mm. wide at the base, slightly constricted below the rounded blackish-brown cornea; the upper surface of the peduncle bears some scattered hairs and a few in tufts; of the latter there are two at its extremity and one seated on a small tubercle situated on the inner aspect about the middle.

Peduncle of first antenna 2·5 mm. long; the first joint short and stout; second slender, more than twice as long as the first; third joint dilated distally, with a few long stiff setæ near the summit.

Smaller flagellum shorter than its supporting joint, consisting of nine subequal articuli, with two or three long setæ; larger flagellum strongly setose proximally; the four terminal joints are elongate, equal and glabrous, except the last, which has a few short hairs at the tip.

Peduncle of second antenna 2·3 mm. long, with a denticulated ridge below its origin which extends upwards and inwards over the bucal orifice. First joint with a short spinule on its outer distal angle and a large, stout, setiferous lobe on the inner. Antennal acicle subcylindrical, without spinules, but bearing a few hairs in the middle and at the summit; equal in length to the first joint and to the inner lobe-like prolongation, reaching as far as the extremity of the second joint; the third joint is more than twice as long as the acicle. Flagellum about as long as the body, sparingly clothed with short hairs.

External maxillipedes about 2·5 mm. long; ischium joint with a row of eighteen equidistant denticles on its inner margin, and a strong spine—projecting at a right angle—near the distal extremity. Merus a little longer than the ischium, with an erect spine at its externo-distal angle; the two following joints are subequal in length and slightly hairy; seventh joint tapering, blunt and densely setose. Second joint of the exopod narrow, elongate, and almost reaching to the base of the sixth joint of the endopod; it is abruptly narrowed near the summit, and bears a few long hairs on its inner margin, and three long curved bristles on its outer border; the terminal joint has a long marginal fringe.

Chelipedes unequal, the right much the larger, about 11 mm. in length. Merus joint trigonus, its greater diameter nearly equal to its length; surfaces smooth; inner and inferior borders minutely spinulose; superior border with a series of scale-like projections, the broadest of which is situated immediately posterior to a subterminal transverse groove.

Right Chelipede x 6.
Fig. 13*a*.

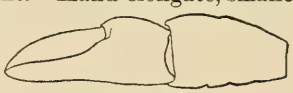
Carpus compressed, wider distally than long, and equal in length to the merus; inner surface deeply excavated and adapted to the inner base of the palm; outer surface covered with round flat scales, of which some are in contact at the base and at the sides. Upper and lower borders rounded, bounded on their external aspect by faint ridges, that on the upper being the most distinct; both are invested with round flat scales, which are rather oblique and raised at their apices; the upper and lower distal extremities terminate in an angular tooth. Hand compressed, slightly convex, its depth equal to four-fifths of the almost straight, rounded lower border; the latter has on its external aspect a faint minutely granular ridge, bounded above by a narrow smooth groove, which extends from the lower point of articulation to the tip of the finger.

Upper border equal in length to the mobile finger, somewhat acute proximally, and clothed throughout with scales, similar to but smaller and less distinct than those on the carpal border.

Lower border, fingers and both surfaces of the palm minutely granulose and slightly setose. Fingers acute, calcareous and crossed at the tips, with a narrow hiatus in the proximal half when closed; inner edge of each with four distinct denticles and two smaller near their bases; a few stiff setæ arise from deepish pits, and alternate with the teeth on the external edge of the lower finger.

Upper finger angular at the base internally; outer and superior surface rounded.

Left chelipede 9 mm. long; meral and carpal joints similar to but more slender than those of the right. Hand elongate, smaller than the carpus; surfaces of palm granulose; lower border straight, with a faint longitudinal ridge.



Left Chelipede x 6.
Fig. 13*b*.

Fingers slender, longer than the palm, meeting along their finely denticulated edges when closed; upper border with a slight granular ridge.

Ambulatory legs stoutish, the second pair a little longer than the first owing to the greater length of the merus and tarsus. Meral joints compressed, one-third as deep as long; surfaces and upper borders more or less scaly-denticulate; the lower borders armed with subspiniform granules.

Carpal joints about 0·1 mm. longer than the depth of the meral, very narrow proximally, rounded and smooth below, with four denticulated ridges above, and a blunt tubercle at the distal extremity.

Propodal joints equal or longer than the tarsal, a little compressed distally; lower borders remotely dentate and setose; lateral surfaces scaly; upper borders closely denticulate.

Tarsal joints compressed, laterally caniculate in the basal half, each armed on the lower border with ten or twelve horny spinules, including the slightly curved claw at the extremity.

Fourth pair of legs moderately slender, about 3·5 mm. long; meral joints equal to propodal and tarsal joints combined; upper borders smooth, lower slightly granular and hairy; posterior surface with an irregular row of setiferous scales, some of which are half cup-shaped; superior distal edges prominent and fringed with long hairs. Carpal and propodal joints more or less beset with distant elevated scales, subtended by tufts of setæ.

Rasp consisting of a single row of about fourteen scales; its length is nearly twice that of the short acute tarsus.

Fifth pair of legs subdorsal, slender, 3·7 mm. long; each coxal joint has a tubular prolongation, directed inwards and downwards, and their apical margins are fringed with long setæ; propodal joint as long as the carpus, densely clothed with longish curved setæ; rasp longer than broad; tarsus short, thick, with numerous rasp-like teeth at the blunt extremity.

Abdomen short, broad and membranous; the anterior segments are indistinct; the terga are narrow, short and barely distinguishable; pleopoda not seen, probably absent or very rudimentary.

Sixth segment calcified, with a median longitudinal groove, and another one arranged transversely.

Uropods equal, strongly calcified; outer ramus 1·1 mm. long and 0·6 mm. wide; rasp oval, with six rows of scales; inner ramus 0·7 mm. long and 0·4 mm. wide; rasp with five rows of scales.

Telson longer than broad, with a slight transverse ridge; lateral margins and the rounded extremity with a thick raised border.

This species resembles *Porcellano-pagurus edwardsii*, Filhol,* but it differs from Filhol's species in many characters, of which the following are the most noticeable :—The unequal chelæ, the prominent external denticles of the front, the less prominent lateral teeth of the anterior sides on the carapace, and the weaker character of the armature and sculpture of the ambulatory legs.

The fifth pair of legs in *P. edwardsii* is represented as chelate, but I failed to find any such character in the example under notice. When viewed under the microscope with transmitted light, the propodus is seen to terminate in two rounded denticulated lobes, one about as long as broad, and the other twice as long as broad ; the latter probably represents the tarsus, but there is no trace of articulation at its base.

Two males of this rare and curious form were obtained off Wata Mooli, in 54-59 fathoms.

GALATHEIDEA.

Section GALATHODEA.

Family GALATHEIDÆ.

GALATHEA, *Fabricius.*

GALATHEA PUSILLA, *Henderson.*

Galathea pusilla, Henderson, Chall. Rep., Zool., xxvii., 1888, p. 121, pl. xii., figs. 1, 1*a* and 1*b*.

Station 44.

Two examples of this species were obtained off Bondi. The larger specimen has a parasite attached to the lower surface of the abdomen—probably a species of Rhizocephala. The "Challenger" examples were infested with a similar form.

The specimens differ considerably from the description and figure given by Henderson. The rostrum is slightly depressed, about 1 mm. long (measured from the lateral spines at the base), and 0·8 mm. wide, the sides gradually sloping to a pair of small

* Filhol—Mission de l'Ile Campbell, iii., 2, 1886, Crust., p. 410, pl. xlix.

but distinct spinules, situated 0·2 mm. from the apex; there are also rudiments of another pair about 0·08 mm. nearer to the extremity than the first.

The lateral margins of the front are deeply concave, smooth, adapted to the eye peduncles, each bearing a pair of spines; there is one at the base of the rostrum and another at the external angle, which is scarcely visible from above; posterior to the latter is a slight groove, immediately in front of the first lateral spine.

The spine at the base of the outer antenna is about 0·6 mm., but does not exceed the cornea of the eye, and cannot be seen from above if the eye is in its normal position; the first exposed joint of the peduncle has a spine on the inner and another one on the outer angle.

The basal joints of the first antennæ are large, subquadrate, with straight contiguous inner borders, the pair forming an operculum behind which the upper portions of the peduncles are concealed; the distal margins of the basal joints are slightly sinuate, and each bears five or six spinules; there is a pair close together near the middle, and the rest are situated on the inner and outer angles; two or three of these spines can be seen from above projecting on each side of the rostrum between the latter and the inner borders of the eye-stalks; the larger spines extend about 0·25 mm. beyond the frontal margin. Figure 1*b* on pl. xii. in the "Challenger" Report represents the general outline and the relative proportions of the joints of the external maxilliped, but the description does not agree with those under notice; the ischium joint, besides being acutely produced at the outer distal border, has a distinct spine on its inner extremity. There is an oblique denticulated crest on the anterior surface which extends longitudinally from just above the base to the summit, which is the highest part of the crest. In the same line on the merus there is a short ridge, but here the denticles are replaced by long setæ; the outer distal spine is slightly curved inwards, but that on the inner is erect, not curved as is stated to be the case in the "Challenger" example.

The chelipede differs from that figured by Henderson (fig. 1*a*) in having a longer carpal joint; the relative proportions of the joints are as follows:—Merus 2 mm., carpus 1·4 mm., palm 1·8 mm., fingers 1·5 mm.; the latter are obtusely rounded and rather strongly denticulated at their distal margins; their outer surfaces are rounded, the inner excavated.

Total length of body	10 mm.
Length of carapace	5 „
„ „ left chelipede	8 „
„ „ second leg	6·5 „

GALATHEA MAGNIFICA, *Haswell.*

Galathea magnifica, Haswell, Proc. Linn. Soc. N.S.W., vi., 1882, p. 761 ; Aust. Mus. Cat. v., Crust., 1882, p. 162, sp. 306.

Station 30.

A single female example of this pretty species was obtained off Botany Bay, at a depth of 43 fathoms. On looking up the type some little difficulty was experienced from the fact that the label on the bottle had been destroyed. As, however, this was the only bottle unlabelled without name or locality it appeared likely that it contained the missing type or types from which the description was drawn. The bottle is of a peculiar kind which was largely used for storing other type specimens by the author of the Catalogue of Crustacea.

The examples agree with the brief description, and some exhibit slight traces of the "brilliant purple stripe down the centre of the carapace."

The following description is drawn from the "Thetis" example, and supplemented by frequent reference to the numerous specimens from Broughton Islands :—

Carapace with about eight or nine striæ, fringed with rather long hairs ; each segment of the pleon has two rows of similar setæ, one on the anterior margin and the other situated in a central transverse groove ; the hairs are everywhere somewhat patent, and give the body a villose appearance, which is quite characteristic, and very different from that of any other species in the Museum collection.

The rostrum is 1·8 mm. long, and 1·4 mm. wide at the base ; the sides have three pairs of spines which are subequal in length ; the terminal spine measures 0·5 mm., and exceeds the distal pair by 0·3 mm. ; each inner angle of the front terminates in a small spine situated at the base of the rostrum, and another one exists on each outer angle. The lateral margins of the carapace have six spines, the first and fourth being slightly larger than the others; each side of the carapace has a small lateral spine situated in a transverse line with the first lateral spine, about twice its own length from the latter, and the same distance or more from the spine on the outer angle of the frontal margin. The gastric area bears a pair of small widely separated spinules situated a short distance behind the base of the rostrum, and in a line with the tips of the median pair of rostral spines.

Basal joints of first antennæ a little longer than broad, armed distally with three large outwardly inclined spines, one on the outer angle and two near the inner, between which the second joint takes its origin.

The basal joint of second antenna has a spine on its outer distal extremity and another somewhat smaller one on its inner; the second joint has also a small spinule on its inner distal angle. The eye peduncle and cornea measures 1·2 mm. in length and is about 0·7 mm. in diameter.

Measured in a median line, the ischium of the third maxillipedes is longer than the merus, the outer distal extremity is somewhat produced but obtuse; the inner border terminates in a spine; the anterior (cutting) ridge has about twenty-eight closely placed denticles; the inner border of the merus bears two strong spines, one at the middle and the other at the distal extremity.

The left chelipede has the merus joint compressed in the proximal half, with almost smooth inner and outer surfaces; the upper border is armed with five or six spinules, three in a line near the base and a pair situated on a slight transverse ridge at a short distance from the distal margin; the latter has four spines, subequal in size and in distance apart, all being visible from above; there are also two widely separated spines on lower margin.

The lower border and inner surface of the carpus are smooth; the external surface is armed with eight spinules, disposed in two longitudinal rows of four each; another row of four occurs on the upper border, and there is a large spine on the interno-distal angle.

Hand compressed; inner and outer surfaces of the palm scaly; external aspect of the lower border bearing a series of six spinules; the distal is somewhat larger than the others; the upper border is armed with five spinules. Fingers slender, rather narrow and excavated internally at the extremities, the lower one terminating in two prominent white denticles, the upper with three very small ones; inner edge of the former finely crenate. Anterior and posterior surfaces of the merus joint of the second leg smooth; lower border with two spines, one near to and the other at the distal extremity; there is also another spine just above the latter on the distal margin. Upper border with seven spines; the distal one is large and prominent.

Carpus with three spines on the upper border and two on the external surface; lower border smooth, with a small spine on the distal extremity.

Propodus with two spines situated on the proximal portion of the upper border; the lower border bears four mobile spinules at about equal distances apart, commencing at the proximal third.

Tarsus compressed, a little curved, tapering to an acute horny claw; lower border armed with six chitinous spinules, which arise from small bracket-like projections.

Total length of body from tip of rostrum to end of telson	14	mm.
Length of carapace, rostrum excluded ...	5	,,
Breadth of carapace...	5	,,
Length of left chelipede (detached) ...	11	,,
,, ,, merus	3·5	,,
,, ,, carpus	2	,,
,, ,, palm...	3	,,
,, ,, mobile finger	2·5	,,
,, second leg	8	,,
,, merus	2·5	,,
,, carpus	1·2	,,
,, propodus	1·9	,,
,, tarsus	1·2	,,

*GALATHEA AUSTRALIENSIS, *Stimpson.*

Galathea australiensis, Stimpson, Proc. Acad. Nat. Sci. Phil., x., 1858, p. 89, sp. 351. Haswell, Aust. Mus. Cat. v., Crust., 1882, p. 161, sp. 304. Miers, Zool. Coll. "Alert," 1884, p. 277, pl. xxxi., fig. (B.).† Henderson, Chall. Rep., Zool., xxvii., 1888, p. 118.

The following are a few important characters which appear to have been omitted in previous descriptions :—

The rostrum is depressed, about 0·9 mm. long and 0·7 mm. wide at the base; when viewed in profile from the side, its tip is in the same plane as the first antero-lateral spines ; the central area is longitudinally grooved and the margins are somewhat inflexed ; the tips of the gastric spines extend over the base of the rostrum.

The ischium joint of the third maxillipedes is longer by 0·1 mm. than the merus ; the inner border is setiferous and has a distinct spine at its distal end ; there is also a small obscure spinule on the outer extremity.

The rather oblique (cutting) ridge on the anterior surface bears about twenty-one denticles ; the preceding joint has also a few indistinct ones.

The merus joint is armed on its inner border with two spines, one large about the middle and the other small and situated near to the distal margin.

Carpus with two or three small spinules on the outer border, subtended by tufts of setæ.

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* Species marked with an asterisk were not obtained by the "Thetis" expedition.

† This should be A according to the lettering of the plate.

The third lateral spine is the largest and more distinct than the same spine in *G. corallicola*, Haswell.

*GALATHEA CORALLICOLA, *Haswell.*

Galathea corallicola, Haswell, Proc. Linn. Soc. N.S.W., vi., 1882, p. 761 ; Aust. Mus. Cat., v., Crust., 1882, p. 161.

In the type specimen the rostrum is 0·8 mm. long and 0·55 mm. wide at the base ; it is slightly depressed, longitudinally grooved, and somewhat inflexed at the sides. The tips of the gastric spines reach to the base of the rostrum.

The ischium joint of the third maxillipedes is equal to the merus; the former has the inner and outer borders setigerous and a rather large spine at its inner distal angle ; the outer is obliquely produced but is rounded at the extremity. The anterior (cutting) ridge bears twenty-five denticles ; four or five are also present in the same line on the preceding joint, but they are very small and ill defined.

The inner border of the merus is armed with two stout spines, one near the middle and the other midway between it and the distal margin ; the outer border has three spinules, of which the distal one is the largest ; the carpus is also armed with three or four small spinules on its outer border.

Length of carapace (rostrum excluded) ...	4·5	mm.
Breadth of carapace...	5	,,
Length of right chelipede	17·5	,,
,, merus	5	,,
,, carpus	3	,,
,, hand	7	,,
,, mobile finger	3	,,

*GALATHEA ACULEATA, *Haswell.*

Galathea aculeata, Haswell, Proc. Linn. Soc. N.S.W., vi., 1882, p. 761 ; Aust. Mus. Cat., v., Crust., 1882, p. 162.

The type of this species, from Holborn Island, has the striæ very prominent and well defined. On the anterior half of the carapace they consist of a series of short curved ridges, and form a neat symmetrical pattern, whilst those on the posterior are long and continuous from side to side. There are four main ridges, posterior to each in the median space, and there is a series of short straight isolated ridges.

There is a pair of gastric spines which are about 0·3 mm. apart, their tips scarcely reaching to the base of the rostrum; several small spinules occur on the surface of the carapace near the antero-lateral border; the latter is armed by eleven spines, three on the front over the space between the eye-stalk and the outer antenna, and one on the side below the insertion of the latter; the remainder form a lateral linear series, the posterior one being situated on the angle of the penultimate ridge.

The rostrum is flat, straight, about 2·2 mm. long and 1·3 mm. wide at the base; the sides have six equal spines, three on each margin; the terminal spine is 1·1 mm. long and exceeds the distal pair by 0·7 mm.; there is a smaller pair of spines near the base of the rostrum, one on each inner angle of the front.

The third maxillipedes have the ischium and merus joints equal in length—measured from the base to the actual apex in each case. The inner distal extremity of the former terminates in a small spinule; the outer is somewhat obliquely produced but not acute; the longitudinal (cutting) ridge on the anterior surface bears about twenty-four denticles; there are also six or seven in the same line on the preceding joint. The merus has two strong spines on the inner border, one in the middle and the other situated between it and the distal margin. The outer border is rounded and smooth.

Length of carapace (rostrum excluded)	...	4·0	mm.
,, left chelipede	...	14	,,
,, merus	...	5	,,
,, carpus	...	3·2	,,
,, hand	...	7	,,
,, mobile finger	...	4	,,

The specimens recorded under this name in the "Challenger" Report by Henderson are probably distinct. In the description the gastric spines are said to be absent, which is not the case in *G. aculeata*, Haswell.

GALATHEA, sp.

Station 57.

There are three examples of what appears to be a new species, but unfortunately they are imperfect; the larger limbs are wanting.

The carapace is 3·5 mm. long by 3 mm. wide; the striæ are fine and about ten in number; rostrum 1·2 mm. long and 0·7 mm. wide at the base, straight, rather deeply grooved, with three pairs of lateral spines; the lowest pair have their tips separated by a space equal to the base of the rostrum; the following pairs are much closer together, owing to the inflection of the margins, the

median pair appearing to arise from the upper surface rather than the sides; terminal spine 0·4 mm. long, exceeding the distal pair by 0·2 mm.; inner angles of the front spinose, one on each side of the base of the rostrum; outer angles obtuse.

Lateral margins of the carapace armed with six spines, the first larger than those following, its apex reaching to the external angle of the front; there are two spinules near its base, one on the upper surface of the carapace and the other on the margin; a third spinule is situated on the lower surface below the lateral margin. The gastric spines are absent.

Eye peduncle about 0·9 mm. long and 0·7 mm. in diameter.

Ischium joint of the third maxillipedes longer by 0·1 mm. than the merus; the outer border is acute and slightly setose; the distal extremity much produced and has a small obtuse spine at its summit; the inner border is also acute, bears numerous setæ, and terminates in a spine. The longitudinal ridge on the anterior surface is armed with sixteen denticles, and there are about six in the same line on the preceding joint.

The inner border of the merus bears three spines, one at the proximal third, one in the middle, and the other at the distal extremity; the outer border has two setiferous scales, one median and the other distal.

This form, should it prove to be new, adds a fifth species to the group, in which the character and spinulation of the rostrum agrees more or less with that of *Galathea australiensis*, Stimpson; the other three are *G. corallicola*, Haswell, *G. aculeata*, Haswell, and *G. magnifica*, Haswell. According to Miers,* *G. corallicola*, from Port Molle, "scarcely differs from *G. australiensis* except in the absence of the gastric spinules." In the type and also in the rest of the specimens—about seven or eight—from Port Molle the gastric spinules are present. In the original brief diagnosis they are described as being absent.

G. aculeata, Henderson,† appears to be a distinct species and not *G. aculeata*, Haswell; the latter has the gastric spinules present, whereas in Henderson's example the "gastric spinules are absent." The brief descriptions given of the above-mentioned species are insufficient for correct determination, and during the comparative examination of the "Thetis" material numerous notes were taken with a view to rendering their identification less difficult in the future. These have been used in drawing up a brief account of each species. The third maxillipedes probably afford the least variable specific characters, and they have been described at some length. In measuring the ischium and merus

* Miers—Zool. Coll. "Alert," 1884, p. 278.

† Henderson—Chall. Rep., Zool., xxvii., 1888, p. 120.

joints the actual relative length of each is often difficult to determine owing to the unequal production of the apical portion; and whether viewed from the superior or inferior surface the same remark applies to the upper spine on the inner border of the merus, which, when viewed from one side, appears to be seated on the distal margin, but seen from the other its tip is about level with the margin The validity of the species enumerated is an open question, and cannot be satisfactorily determined until a larger series of each are available; the amount of variation in the parts relied on as specific characters may then be estimated.

Under these circumstances it has been deemed best to leave the closely allied forms as they were, and give a brief description of each. The species dealt with in this manner are *G. australiensis*, *G. corallicola* and *G. aculeata*, none of which were obtained by the "Thetis" expedition.

The two remaining forms—*G. magnifica* and the species under notice—have been treated as fully as the material would admit; both appear to be quite distinct from any other Australian forms.

They were obtained off Wata Mooli, in 54-59 fathoms.

MUNIDA, *Leach.*

MUNIDA HASWELLI, *Henderson.*

Munida haswelli, Henderson, Chall. Rep., Zool., xxvii., 1888, p. 139, pl. iii., fig. 5, 5*a*-5*b*.

Stations 37, 48, 56, 57.

About sixty examples of this species are in the collection, ncluding many young and a few females bearing ova. The largest male is about the same size as the type. The right chela agrees with that figured by Henderson in the relative proportion of the fingers to the palm, and also in the number of spines, of which there are five on the upper border. It is stated in the explanation of figure 5*a* that the chela is "doubtfully referred to this species." It appears to have been correctly delineated, and well represents the right chela as seen in the majority of the "Thetis" specimens. In some of the larger individuals of both sexes the fingers are not straight, but bent outwards at the base, and have a wide gap between their proximal edges when closed. The spinulation of the external maxillipedes differs slightly from the description given by Henderson. The inner border of the merus joint has five spinules, of which the proximal is large, the distal moderate, and the three between small; the outer border has six spinules—the distal one of moderate size, the remaining five

become gradually less as the proximal end is approached. The inner margins of the sixth and seventh joints are clothed with numerous stout setæ, many of which are biserrate, the teeth being a little longer than broad at the base, and are confined to the distal half or third; there are two or three long smooth bristles at the extremity of the seventh joint.

Obtained off Botany and Wollongong, in 50 to 80 fathoms.

MACRURA.

Group NORMALIA.

Tribe SYNAXIDEA.

Family SCYLLARIDÆ.

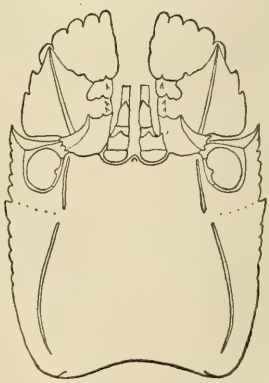
ARCTUS, *Dana.*

ARCTUS CRENATUS, sp. nov.

(Fig. 14.)

Station 57.

The carapace measures 5·2 mm. in length, its breadth anteriorly is 6·5 mm., between the orbits 3·5 mm., and at the posterior border 5·3 mm; each lateral margin is armed with a series of fourteen obscure denticles, usually disposed in pairs; the posterior tooth of each pair is small and sometimes wanting; there are five denticles in advance of the shallow cervical incision; the remainder occur at equal distances apart, and extend to near the posterior end of the carapace. The front has a small obtuse rostriform process, surmounted by a tubercle; the margin has a raised border, which is continued on each side of the process along a wide sinus to a point external to the bases of the first antennæ; the border is here abruptly curved inwards, and terminates in a small tubercle; from the latter to the external angle of the orbit the margin is slightly deflexed.



CARAPACE x 5.
Fig. 14.

Orbital border smooth, elevated ; the cavity longer than broad ; inner angle prominent, obtuse, outer angle with a very small tubercle ; anterior extra-orbital angle acute, equal to the breadth of the orbit, and projecting about the same distance beyond it. Upper surface of carapace minutely and remotely hairy, central area punctate, nearly smooth, hepatic and branchial regions more or less granulose. There is a pair of prominent lateral carinæ commencing at the inner angle of the orbit from the latter point to the ill-defined cervical groove ; the course of the carinæ is straight, from thence they are slightly curved outwards, and terminate near the hinder margin ; each keel is capped by a series of short ridges, which are slightly higher at their anterior end, but are scarcely dentiform.

The gastric region is moderately elevated, and is bounded in front and laterally by a sharply defined narrow groove ; anteriorly there is a short ridge, and posteriorly a broadish tubercle, and a smaller one on each side near its outer limits.

Cardiac region somewhat higher than the gastric, with a submedian pair of short granular ridges anteriorly, and a widely separated pair of granules posteriorly. Hinder margin of carapace with a transverse line of four or five granules situated near the centre.

Pleon smooth, without any distinct arborescent markings ; the first three segments with a well-marked median notch on the posterior border, second to fifth slightly carinate centrally ; the second is rather higher than the rest, and somewhat granulose ; sixth segment with an obscure pair of widely separated lobes on the posterior border.

There are four pairs of pleopoda, but the first pair are wanting ; the rami are long, narrow and setiferous ; the inner ramus is equal in length to the peduncle, and bears a single stylamblys, which is a little longer than the ramus, somewhat swollen apically and tipped by a series of small papillæ.

The distal margin of the calcified portion of the outer ramus of the uropod is truncated and bidentate ; that of the inner ramus is oblique and tri- or quadridentate. The telson is marked by a pair of short, elevated, longitudinal ridges, situated proximally and rather nearer the margins than the centre ; the calcified portion has a deep, broad, central emargination, and each distal border is transversely truncated and bispinose ; the spines are subequal ; there is one on the inner and another on the outer angle.

Eyes dark brown, with lighter reticulations ; cornea 0·9 mm. in diameter ; the outer margin of the orbit is separated from the external border of the carapace by a space about 0·3 mm. wide.

The first antennæ are 3·3 mm. in length; the basal joint is stout, compressed, and has a short process on its superior distal extremity, which bears an obtuse spine; its length without the process is equal to the second joint; the third joint is two-thirds the length of the second; it is somewhat dilated distally, and terminates superiorly in an acute point.

Outer flagellum one-third shorter than the inner, consisting of eleven articuli; the basal pair are broad, long and glabrous; the first is twice as long as the second; the third to the eighth equal in length, gradually diminishing in diameter, and densely setiferous; ninth very narrow, elongate; terminal pair equal in length. Inner flagellum with thirteen articuli, all subequal in length except the first two, which are twice as long as those succeeding.

Second antennæ 2·6 mm. long, and 2·1 mm. wide; the basal joint has several spines on the superior surface; three spines occur on the produced outer border, and two on the distal margin —one in the middle, and the second midway between it and the inner border. The second joint has two spines in a longitudinal line near the inner border; the distal margin bears three spines, one on and another near to the inner angle; the third is situated at the onter angle, and marks the termination of a slightly curved diagonal crest; the outer border has two denticles—one in the middle and the other in a transverse line with the inner angle. Third joint small, with a ridge-like spine near its inner border. The distal margin of the fourth joint is slightly ciliated, and has five evenly rounded teeth, the internal one being rather narrower than the rest; the outer border is smooth, and the inner bears two small denticles.

The ischium joint of the external maxillipedes has a distinct, smooth, longitudinal ridge on the inferior surface near the inner border; a similar ridge occurs in the same line on the merus; the former joint is longer than broad; its length exceeds that of the latter, and also that of the exopod; the merus tapers rapidly beyond the middle, especially on the inner border.

Carpus as broad as long, nearly circular in outline; its outer border, distal margin and superior distal surface closely covered with plumose hairs.

Propodus shorter than the preceding joint; its width is equal to the length of the tarsus; the latter terminates in a small spinule; a few stiff setæ are scattered here and there on the inner borders of the last two joints.

The anterior legs are stout, and much shorter than those succeeding; the propodal joint varies greatly in length; in the first leg it is shorter than the tarsus, in the second the two joints

are subequal, in the third and fourth the propodus is somewhat longer, and in the fifth it is nearly twice as long as the tarsus.

There is a pair of strong backwardly directed spines at the inner bases of the coxal joints of the posterior pair of legs; similar spines are present in *Arctus immaturis*, Bate.*

Two male examples were obtained off Wata Mooli, at a depth of 54 to 59 fathoms.

DENDROBRANCHIATA.

Group NORMALIA.

Tribe PENÆIDEA.

Family PENÆIDÆ.

PENÆUS, *Fabricius.*

PENÆUS CANALICULATUS, *Oliver.*

Penœus canaliculatus, Oliver, Encycl. Method., viii., 1811, p. 660.
Bate, Chall. Rep., Zool., xxiv., 1888, p. 245, pl. xxxi., pl. xxxii., fig. 4, pl. xxxvii., fig. 2.

Stations 22, 23, 41, 50.

Examples of this common species were obtained off Newcastle and Shoalhaven Bights, in 15 to 52 fathoms.

PENÆUS MACLEAYI, *Haswell.*

Penœus macleayi, Haswell, Aust. Mus. Cat., v., Crust., 1882, p. 201, No. 375.

Station 50.

Two specimens were secured off Shoalhaven Bight, in 15-18 fathoms.

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* Bate—Chall. Rep., Zool., xxiv., 1888, pl. x., fig. 3.

PHYLLOBRANCHIATA.

Group NORMALIA.

Tribe CRANGONIDEA.

Family CRANGONIDÆ.

Genus PONTOCARIS, *Bate.*

PONTOCARIS PROPENSALATA, *Bate.*

Pontocaris propensalata, Bate, Chall. Rep., Zool., xxiv., 1888, p. 496, pl. xc., figs. 2, 3.

Station 37.

A single imperfect example of this species was obtained off Botany Bay, at a depth of 50 fathoms.

The Challenger specimen was obtained off Ki Islands at Station 192, at a depth 140 fathoms.

STOMATOPODA.

Family SQUILLIDÆ.

PSEUDOSQUILLA, *Guérin.*

PSEUDOSQUILLA STYLIFERA, *H. Milne-Edwards.*

Gonodactylus stylifera, H. Milne-Edwards, Hist. Nat. Crust., ii., 1837, p. 530, pl. xxvii., figs. 9, 14. Gay, Hist. Chile, Zool., iii., 1849, p. 225, pl. ii., fig. 3.

Pseudosquilla stylifera, Miers, Ann. Mag. Nat. Hist. (5), v., 1880, p. 112. Bigelow, Proc. U.S. Nat. Mus., xvii., 1894, p. 502, p. 505, fig. 3.

Station 21.

Three examples of this species were obtained off Newcastle Bight, in 28 to 40 fathoms. They exhibit a few characters worthy of notice, and they differ slightly from the published figures.

The rostral plate is a little longer than broad, and attains to but does not overlap the bases of the ocular peduncles. In Gay's

and also in Milne-Edwards' figure the rostrum is depicted as covering the bases of the eye-stalks. In Bigelow's figure it is represented as just reaching their bases.

The carpal joint of the raptorial limbs has a small acute spine on its superior distal extremity. The propodal joint has two mobile spines situated proximally on the inner side of the upper border; the posterior spine is much the larger; the proximal two-thirds of the outer aspect of the superior border is finely denticulated.

Miers states that the "basal prolongation of the uropoda terminates in a large flattened lobe, which is denticulate on its inner margin and ends in a spine." In the examples under notice the inner margins are quite smooth throughout, and they are represented as being smooth in Bigelow's figure.

The penultimate joint of the outer ramus of the uropoda has a small spine at the distal extremity inferiorly, and four mobile spines on its outer distal angle, of which the proximal one is small; those following rapidly increase in size, the fourth often being one-third as long as the terminal joint.

The terminal segment agrees exactly with the figure given by Bigelow.

Outer laminæ of uropoda brilliant violet when alive; in formol, pale violet, the marginal fringe crimson.

Length of largest specimen from the tip of the rostrum to the end of telson, 130 mm.

This and the following species have not hitherto been recorded from Australian waters.

Habitat.—Chile; San Pedro, California.

SQUILLA, *Fabricius.*

SQUILLA ARMATA, *H. Milne-Edwards.*

Squilla armata, H. Milne-Edwards, Hist. Nat. Crust., ii., 1837, p. 521. Gay, Hist. Chile, Zool., iii., Crust., 1849, p. 223. Kirk, Trans. N Z. Inst., xi., 1878, p. 401. Miers, Ann. Mag. Nat. Hist. (5), v., 1880, p. 26. Chilton, Trans. N.Z. Inst., xxiii., 1890, p. 60. Bigelow, Proc. U.S. Nat. Mus. xvii., 1894, p. 515, figs. 9-10.

Station 8.

One female example of this species was obtained off Barranjoey, in 25-28 fathoms; it measures 80 mm. from the top of the rostrum to end of the telson.

Habitat.—Chile; New Zealand.

Note.—The figures in the text have been reproduced by zincography from the author's drawings.

PUBLICATIONS OF THE AUSTRALIAN MUSEUM.

MAY, 1900.

I.—CATALOGUES.

1. Catalogue of the Specimens of Natural History and Miscellaneous Curiosities in the Australian Museum, by G. Bennett. 1837. 8vo. pp. 71. (Out of print.)

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MEMOIR IV.

SCIENTIFIC RESULTS

OF THE

TRAWLING EXPEDITION

OF

H.M.C.S. "THETIS,"

OFF THE COAST OF NEW SOUTH WALES,

IN

FEBRUARY AND MARCH, 1898.

PART 3.—Published 26th February, 1901.

PUBLISHED BY ORDER OF THE TRUSTEES.

R. ETHERIDGE, Junr., J.P., Curator.

SYDNEY, 1901.

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CRUSTACEA.

PART II.

By THOMAS WHITELEGGE,

Zoologist, Australian Museum.

ISOPODA.

Part I.

MAY 22 1901

CRUSTACEA.

PART II.

By Thomas Whitelegge,

Zoologist, Australian Museum.

ISOPODA.

Part I.

The present contribution deals with a portion of the Isopoda, and embraces representatives of seven families, eleven genera and eighteen species; of these, two genera and nine species are herein described as new to science and are as follows :—

Apseudes multicarinatus.

Pagurapseudes spinipes.

Paranthura ciliata.

„ *involuta.*

Calathura gigas.

Ægа australis.

„ *angustata.*

Cassidina laticauda.

Cassidinella incisa.

The species previously known are :—

Anthura affinis, Chilton. (*Hab.*—New Zealand).

Nerocila laticauda, Schiœdte and Meinert. (*Hab.*—Port Western, Vict.).

Livonecta raynaudii, H. Milne-Edwards. (*Hab.*—New Zealand and Tasmania).

Serolis tuberculata, Grube. (*Hab.*—Bass' Strait).
„ *australiensis*, Beddard. (*Hab.*—Coast of Victoria).
„ *elongata*, Beddard. (*Hab.*—Port Jackson).
„ *pallida*, Beddard. (*Hab.*—Off Port Jackson).
„ *longicaudata*, Beddard. (*Hab.*—Coast of Victoria).
„ *minuta*, Beddard. (*Hab.*—Off Port Phillip, Victoria).

The figures in the text have been reproduced by zincography from the author's drawings.

ISOPODA.

Tribe I.—CHELIFERA.

Family APSEUDIDÆ.

APSEUDES, *Leach.*

APSEUDES MULTICARINATUS, sp. nov.

(Figs. 15*a-g*.)

Stations 35, 37, 38, 57.

Body slender, strongly calcified, gradually tapering from the third to the terminal segment. Front of the cephalon but little prominent, rostral spine triangulate, as long as broad, the base occupies the median third of the front, the apex is slightly deflexed and the margins are finely denticulated, the denticles are continued beyond the base and cease at a short distance from the obtuse, elevated lateral angles of the front.

Ocular lobes well defined; an oblique ridge is present superiorly and the outer distal border is obtusely rounded.

Eyes conspicuous, with six or seven distinct, pigmented ocellæ.

Upper surface of cephalon strongly areolate, and carinate; the posterior sides are tumid, evenly rounded, and exhibit numerous low, reticulated ridges; one is more strongly marked, and extends obliquely from beneath the ocular lobe to the upper lateral aspect of the posterior border.

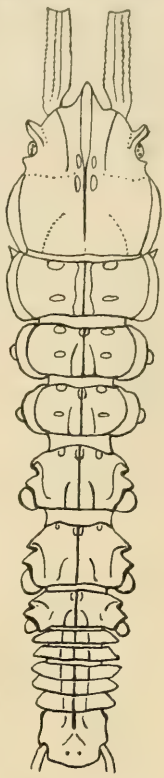
A longitudinal submedian pair of carinæ commence on the rostral spine and are continued to the cephalic suture; at this point they unite and form a single median keel, which ceases at a short distance from the acutely ridged hinder margin.

There is a low longitudinal ridge on each side, commencing at the antero-lateral angle of the front and terminating near the sutural depression; the latter marks the limits of four short longitudinal ridges, of which the posterior pair subtends the median and the anterior pair the submedian carinæ.

Second (first free) segment as wide as the first, but a little shorter, third segment shorter than the fourth and about one-third longer than the seventh, the fifth and sixth are subequal in length and breadth.

All the free segments are marked superiorly by a well defined median keel and a submedian pair; the latter varies in length on the different segments. On the second they extend along the whole length of the segment, on the third they are confined to the posterior two-thirds, and on the remaining segments of the peraeon they commence about the middle and terminate at the posterior border.

The submedian ridges are bounded on each side by a pair of short transverse ridge-like tubercles; the larger one is seated on the anterior border and the smaller about the middle of the segment; they are separated by a narrow transverse depression.



BODY VIEWED FROM ABOVE.

Fig. 15*a*.

The second, third and fourth segments of the peraeon are widest in the middle; the sides when viewed from above have an evenly curved outline; fifth, sixth and seventh segments wider behind than in front, the marginal outline being oblique and bidentate.

Each epimeral process bears a pair of strongly marked ridges.

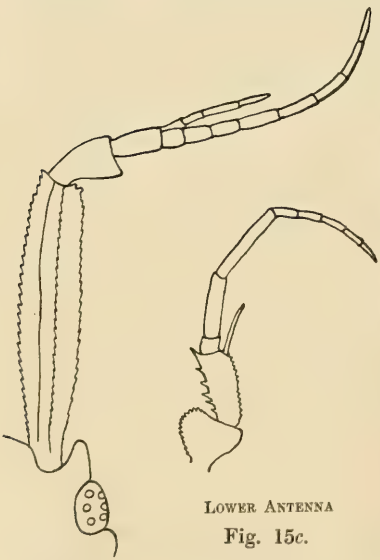
Coxal joints of the second pair of legs, with a small angular spine-tipped process, directed outwards and forwards; each succeeding coxa bears a broad incisor-like lobe; the lobes of the third and fourth are overhung and almost concealed by the epimeral processes, but those of the succeeding segments are very

prominent and project considerably beyond the second epimeral denticle and give each lateral margin a tridentate outline.

There is a spine on the epistome, and a triangular denticle between it and the inferior base of the rostrum. The second, third, fourth and fifth segments have a central longitudinal ridge on the inferior surface; the first three have a spiniform process anteriorly; the ridges are absent on the sixth and seventh segments.

An ill-defined central, compressed denticle is present on the under surface of five of the pleon segments, and there is also a pair of prominent, submedian, truncated processes to which the pleopoda are articulated. Segments and epimeral processes of the pleon subequal, sides obtuse, with the anterior margin oblique and the posterior nearly straight. Terminal segment truncated, as long as the three preceding combined. Upper aspect with a submedian pair of short spines posteriorly and a strong, short, median ridge on the anterior half of its surface. Sides sloping, becoming wider to the insertion of the uropods, beyond which the margins are keel-like and minutely denticulate.

The upper antennæ have the basal joint tapering, triangular, and about three times as long as broad, the angles are rather strongly denticulated and the superior surface carries a low smooth longitudinal ridge; the lower distal extremity bears a small spinule. The second joint is wider above than below and is a little longer and much stouter than the third. The larger flagellum consists of eight articulations; the first three are equal; the succeeding joints are about one-third longer and of nearly equal length; all except the first pair bear two or more setæ at their extremities. Smaller flagellum with four articulations, the first two of which are equal; the third is much the longest; distally each joint carries two or three setæ.



Upper Antenna.
Fig. 15*b*.

Lower Antenna
Fig. 15*c*.

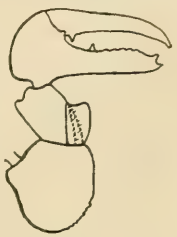
Lower antennæ having the peduncle shorter than the basal joint of the upper; first joint short, broad, with a denticulated

lobe on its inner margin; second twice as long as broad, inner margin armed with five or six spinules, outer denticulated.

Antennal scale cylindric, three times as long as broad and twice as long as the third joint; there is a pair of setæ at the summit and one at the side. Fourth joint one-third shorter than the fifth, the latter being about equal to the second. Flagellum with five subequal articulations.

The first legs have the basos as broad as long; the outer surface is convex, the inner is flattened and bears an oblong transverse depression; the inferior border is angular and denticulated, the denticles being most strongly marked posteriorly.

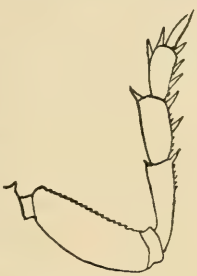
Hand oblong, its length exceeding the preceding joints combined. Palm short, as deep as long, and about half the length of the mobile finger, outer surface a little convex, inner with a longitudinal angle terminating in a prominent, broad, compressed lobe which marks the boundary of a deep, inter-digital excavation. Immobile finger horizontally dilated; the inner border is rounded, nearly straight and terminates in a short, curved, horny spine; the outer border is strongly curved thin, produced and indistinctly denticulated in the middle, and bears a strong calcareous spine distally. A faint longitudinal ridge is present on the inner surface of the finger, and frequently a large blunt cylindrical tooth which is situated about the proximal third. Mobile finger rounded, tapering, distally curved, with a strong, inwardly directed tooth on its inner base and a corneous spine at its extremity.



Right Chelipede of Male.

Fig. 15*d*.

The second pair of legs has the basos joint about one-third as wide as long; the anterior border is straight and denticulated throughout. Merus angular; its width distally is about twice that of its base; the lower border is minutely denticulate, the upper is smooth, and the external surface bears an ill-defined longitudinal granular ridge; there is a small spine at the distal extremity above and a large one below. Carpus twice as long as broad and about two-thirds as long as the merus; the lower border bears a few small denticles, a pair of large spines and two unequal setæ; there is a spine at the superior distal extremity and one or two granular ridges on the external surface. Propodus one-third longer than broad, upper border armed with two and the lower with three spines and three setæ; the distal

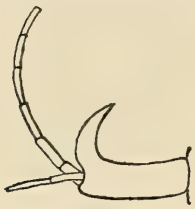


Second Right Leg.

Fig. 15*e*.

spines are large and about half the length of the dactylus; the lower border of the latter is beset in its proximal half with denticles, similar to those existing on the three preceding joints.

The third and fourth legs have the anterior border of the basos denticulated, and the lower borders of the carpal and propodal joints are armed with about twelve or more long, equidistant spinules. The propodus joint of the fifth leg is abbreviated and thickened at the extremity, which bears two transverse rows of setæ; each seta has numerous short branches arranged along its concave surface; the dactylus is much shorter than in any of the preceding or following legs.



Uropod.
Fig. 15*f*.

A few plumose hairs are present on the proximal parts of all the legs and on the various angles of the body.

Uropods stoutish, equal in length to the external margin of the supporting segment; each terminates superiorly in a strong, acute, curved spine, directed upwards and forwards. Outer ramus short, with two articulations; inner about twice the length of the pleon and consisting of sixteen articulations.

The female differs from the male in having the first pair of legs much less robust in character; the hand has the palm longer than the fingers.

Left Chelipede of Female.
Fig. 15*g*.

The expodites, if present, are minute and not distinguishable from some of the stouter setæ.

Colour, in spirit, body reddish-cream, sides of cephalon and central carinæ light terra-cotta.

About one hundred and twenty examples, obtained off Port Hacking, Jibbon, Botany, and Wata Mooli, in 20-59 fathoms.

Total length of body ...	...	...	...	6·8 mm.
Length of cephalon ...	...	...	...	1·7 „
„ „ peraeon ...	...	...	...	3·7 „
„ „ pleon ...	...	...	..	1·4 „
„ „ left chelipede	...	...	...	3· „
„ „ second left leg	...	...	...	4 „
„ „ third left leg	...	...	...	2·3 „
„ „ seventh left leg	...	...	...	1·5 „

PAGURAPSEUDES, gen. nov.

Body slender, tapering and dorso-ventrally compressed, with the free peraeon segments sharply defined, and the small coxal joints visible at the sides.

Second (first free) segment short, somewhat firmly connected with the first.

Pleon narrow, subcylindric, with five equal hoop-like somites and a short terminal segment.

Ocular lobes distinct, eyes present, pigmented but ill defined.

First antennæ widely separated, stout, with three joints and a pair of multiarticulate flagellæ.

Second antennæ inserted, at the inner inferior base of the first, small and four-jointed, with a rudimentary flagellum, but without an antennal appendage.

Mandibles robust, with a stout three-jointed palp, a well developed molar tubercle and a pair of dentate blades; the lower is subtended inferiorly by a tuft of spines.

First maxillæ bilobed; the outer is spinose and the inner setose at the apex; the external base carries a two-jointed, backward-directed palp.

Second maxillæ three-lobed and strongly setose at the apices.

First pair of legs chelate, the chelæ rather small, subequal, and similar in shape in the two sexes; inner edges of fingers of larger hand of male with small tubercles.

Second pair of legs elongate, slender, with a two-jointed exopod (in the male); the fifth and sixth joints are subcylindrical and narrower than the fourth; the seventh joint is long, curved and tapering.

Third to seventh pairs of legs short; each leg has the fourth, fifth and sixth joints armed inferiorly with a broadish band of rasp-like teeth. The dactyli of all the legs—except the first—exhibit an imperfect joint near the extremity.

Pleopods rudimentary, each with a pair of equal, sparsely setiferous rami.

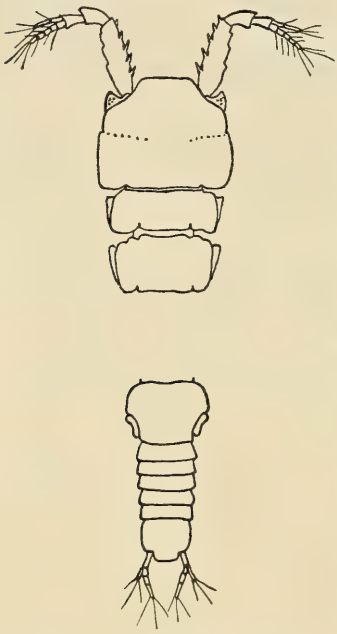
Uropods of moderate length, the rami short and composed of few articulations.

PAGURAPSEUDES SPINIPES, sp. nov.

(Figs. 16*a*-*h*.)

Stations 13, 35, 37, 38, 57.

Adult female. Body slightly tapering, upper surface without well defined sculpture. Cephalon as long as broad, sides a little sloping, narrowed anteriorly, with a faint groove, which extends to the point of articulation with the succeeding segment.



ANTERIOR AND POSTERIOR REGIONS OF BODY.
Fig. 16*a*.

Upper surface with a pair of very shallow submedian depressions and a low, broad median elevation; the latter commences on the rostrum and is continued beyond the sutural line; the depressions mark the inner limits of the suture and cease opposite to, but at a short distance from, a pair of shallow pits, situated anterior to the straight posterior border.

Rostrum wide, depressed, truncated and minutely spinulose.

Ocular lobes sharply defined, outlines when viewed from above triangular, with an inner ridge-like process, which extends over the base of the first antenna to the external base of the rostrum.

Eyes indistinct, with several dark pigment spots.

Second (first free) segment about half the length of the third. Anterior margin straight, sides slightly convex, marked superiorly with a narrow groove, bounded by a ridge which gradually increases in width posteriorly; hinder border interrupted by a pair of submedian incisions.

Third segment with the anterior border arcuate, exhibiting six indistinct depressions, and laterally spinulose; sides and posterior border straight, the latter with a pair of widely separated notches.

Fourth segment similar to the third, but longer.

Fifth segment nearly equal in length to the second and third combined.

Sixth and seventh segments subequal in length; both have the anterior border strongly arched; the sides posteriorly exhibit a slight excavation, which is adapted to the coxal plates; the posterior borders are straight and furnished with minute notches externally.

Pleon when viewed from above cylindric, without projecting side processes, its width being rather more than half that of the last segment of the peraeon.

First segment rather longer than the four following.

Telson a little tapering at the sides and obtuse at the extremity.

The body and limbs are more or less beset with branched setæ; on the prominent angles they are stout, and when broken the bases of the setæ resemble small spines. Superior antennæ having the peduncle as long as the cephalon, basal joint more than three times as long as broad, outer border with three equidistant double pointed denticles confined to the distal half, inner border armed with eight spines arranged in pairs; the largest pair is situated at about the proximal third, the remainder forms a gradually diminishing series; the inferior distal extremity terminates in a subacute prolongation.

Upper Antenna.
Fig. 16*b*.

Second joint as long as the width of the first, becoming wider distally; third joint equal in length, but narrower than the second.

Inner flagellum two-jointed, the second slender and a little longer than the first; each is tipped by three or four short simple setæ. Outer flagellum with five joints subequal in length, each bearing from two to six longish setæ.

Inferior antennæ small, about equal to the length of the palp of the mandible; first joint dilated, as long as the three following, oval in outline, about one-sixth longer than wide; outer border evenly curved and minutely spinulose about and above the middle, with a large spinule at distal extremity; inner border with three spinules on the distal fourth and a large denticle below the middle, bounded superiorly by a well defined sinus. Second joint as long as broad and about half the length of the third; fourth joint a little shorter than the second and third

Lower Antenna
Fig. 16*c*.

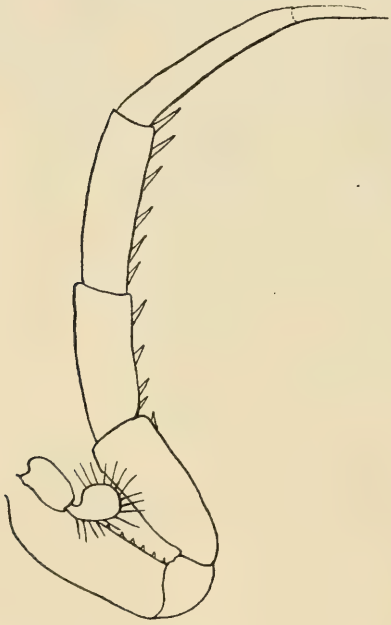
Mandible.
Fig. 16*d*.

combined; flagellum rudimentary, two-jointed, terminating in a pair of setæ, of which one is very long.

First pair of legs having the basos joint as long as broad, scarcely exceeding the joint following in bulk; fifth joint much the largest, twice as long as broad, becoming wider distally; there is a slight transverse subdistal ridge on the external aspect, and a longitudinal ridge on the inner; each bears a few short spinules.

Hand small, curved, more than twice as long as deep, strongly convex externally, and bent downwards at right angles to its

RIGHT CHELIPEDE OF MALE.
Fig. 16*e*.



SECOND LEG OF MALE.
Fig. 16*f*.

RIGHT CHELIPEDE OF MALE.
Fig. 16*g*.

supporting joint. Fingers moving in a horizontal plane, the lower straight, upper slightly curved, as long as the palm, inner edges of both denticulate, with the tips acute and corneous.

Second pair of legs elongate, slender, coxal joint visible from above, wide in front and narrow behind, tipped with a small spine externally, but without a forwardly directed process. The coxæ of the third and fourth pairs are similar to those of the second, whilst those of the succeeding legs are as wide behind as in front when seen from the dorsal aspect. Basos twice as long

as the ischium and equal to the merus in length and breadth, with a few small denticles on the anterior border. Merus as long as the carpus, inferior border of the former with about six strong branched setæ, and that of the latter armed with four or five short mobile spines. Propodus longer and narrower than the carpus, equal to the dactylus; the inferior border carries six mobile spines, which slightly increase in size distally.

Dactylus slender, tapering, with a horny claw occupying the distal fourth and preceded by an imperfect joint.

Third to seventh pairs of legs, and also each sixth and seventh joint, gradually diminishing in size as the posterior end of the peraeon is approached.

Third pair of legs having the basos joint stout and nearly equal in length to the three following joints combined; merus and carpus equal, shorter than the propodus; the latter is narrow, subcylindric and not equal in length to the slender but little curved dactylus.

Third Leg of Male.
Fig. 16*h*.

In the remaining pairs of legs the basos is less than twice as long as broad and equal to or exceeding the combined length of the three succeeding joints. The propodal joint is about as long as the ischium and one-third shorter than the dactylus. There are some branched setæ on the anterior borders of the second joints, and a rather wide band of rasp-like spines on the inferior surfaces of the fourth, fifth, and sixth; the latter bears a short, simple, spine-like seta on the superior distal extremity, and a curved pectinated spine inferiorly.

The pleopods are subject to great variation; there are never more than three pairs, often only one, and frequently they are wholly absent, especially in the female; they are very small and consist of a short pedicle and two narrow equal setæ tipped rami.

Uropods about equal in length to the telson; outer ramus with one joint, twice as long as broad, and surmounted apically by three setæ; inner ramus three-jointed, the first a little longer than broad, the second and third subequal and about twice as long as broad; the middle joint bears two, and the terminal one three simple stoutish setæ.

The male differs from the female in having the joints of the larger flagellum of the first antennæ longer, the chelipedes slightly larger, particularly the right. The rasp-like teeth are better developed, more especially on the terminal joints of the posterior

legs. The second pair of legs has each a well developed two-jointed exopod. The latter appendages, if present on the first legs of the male or on both first and second in the female, are so small that they have eluded all my efforts to isolate them and distinguish them from the stout branched setæ.

Incubatory pouches occur in pairs on the second to fifth segments.

The young when ready to leave the marsupium have the eyes conspicuously pigmented; the first joint of the first antennæ possesses only one spine, situated about the middle on the inner border. The larger flagellum has but three joints and exceeds the smaller in length by about one-fifth. The second to the sixth pairs of legs have the imperfect joint of the dactylus well defined and the rasp-like spines of full size, but not so numerous as in the adult. The seventh pair of legs and the pleopods are wanting in all the specimens examined.

The predominating features of this most curious and interesting form indicate its close relationship to the family Apseudidæ. The ocular lobes, antennæ and mouth parts are very similar in structure, yet there are certain differences, such as the absence of the antennal scale and the small size of the second antennæ, which are scarcely equal to the stout, well developed palp of the mandible. The slightly tapering body and the presence of a conspicuous exopod on the second pair of legs afford further evidence. Here I may state that after examining very many specimens I failed to find the exopods except in one male, in which they are very conspicuous on the anterior bases of the second legs, but I could not detect any trace of them on the first pair.

Many of the remaining characters display an affinity with the family Tanaidæ, such as the almost smooth body, the second pair of legs not having the distal joints dilated, the small size of the coxal plates and the absence of a forward process on the first pair, the semi-coalesced condition of the first five segments of the pleon, which consists of hoop-like rings, without side processes and devoid of visible nodes of articulation, the frequent absence and rudimental character of the pleopods, and the short, few-jointed rami of the uropods.

Colour, of body and limbs, creamy-white.

About one hundred specimens, obtained off Cape Three Points, Port Hacking, Botany to Jibbon, and Wata Mooli, in 20-59 fathoms.

Total length of body	6·25 mm.
Length of cephalon	1·2 „
„ „ peraeon	3·8 „
„ „ pleon	1·25 „
„ „ first antenna	1·5 „
„ „ second antenna	0·4 „
„ „ palp of mandible	0·45 „
„ „ first chelipede	2·5 „
„ „ second leg	2·7 „
„ „ third leg	1·25 „
„ „ seventh leg	0·8 „
„ „ first pleopods, with the setæ ...	2·0 „
„ „ third „ „ „ ...	1·5 „

In habit as well as in structure this species is equally remarkable, and affords a striking instance of adaptation to a mode of life quite different from that of other members of its tribe. It is distinctly paguroid in habit, living in small univalve shells and in company with young hermit crabs. The resemblance to the latter is so complete that it requires close inspection to separate the two forms. This mimicry of external appearance and the similarity of the habitat are of extreme interest from a homoplastic point of view, showing how habit and environment tend to induce the development or degradation of a number of important homogenetic characters in widely separated organisms. The paguroid features presented by this singular Isopod may be enumerated as follows:—The body is strongly curved and adapted to the shape of the columella of the shell, as are also the chelipedes, neither of which can be straightened without breaking. The hands are distinctly curved and very similar to those of the young of many species of *Clibanarius*, the fingers moving in a horizontal plane. The second pair of legs is long and ambulatory, not dilated and fossorial as in its nearest allies. The succeeding five pairs of legs are greatly reduced in size and the inferior surfaces of the fourth, fifth and sixth joints are clothed with numerous short, rasp-like teeth, identical in form, origin and structure with the pad or rasp present on the reduced legs of the pagurids. The pleon is symmetrical, but together with its appendages exhibits evidences of degradation. The segments do not display any points of articulation; inferiorly they are very short, interrupted and only partially calcified. The pleopoda are frequently absent; when present they are small and rudimental. The uropods with their rami do not exceed the telson in length.

Tribe II.—FLABELLIFERA.

Family ANTHURIDÆ.

ANTHURA, *Leach.*

ANTHURA AFFINIS, *Chilton.*

Anthura affinis, Chilton, Trans. New Zeal. Institute, xv., 1882, p. 72, pl. 1, fig. 4.

Station 37.

One example of this species was obtained off Botany Bay in 50-52 fathoms.

Total length of body, 10 mm. The specimen agrees exactly with Chilton's description and figures. The eyes are subreniform and of a dark brown colour; the body and limbs exhibit very numerous discoidal bodies under the integument.

PARANTHURA, *Bate and Westwood.*

PARANTHURA CILIATA, sp. nov.

(Figs. 17*a-f.*)

Station 57.

Body elongate, very slender; cephalon one-fifth longer than broad; sides straight, narrowed and rounded in advance of the eyes. Front with a short distinct rostriform process. First segment of the peraeon one-fourth longer than the cephalon, and twice as long as broad in the middle. Second segment much longer than the first, very narrow posteriorly; third, fourth and fifth segments subequal in length, each slightly increasing in width; sixth segment equal in length to the first, and nearly as broad as the cephalon is long; seventh segment broader than long; upper surface of cephalon and two following segments convex from side to side; the remaining five segments are somewhat flattened and bounded at the sides by a raised marginal pigmented line. Inferior surface of second peraeon segment

strongly keeled, the succeeding ones more or less flattened with a pigmented marginal line on each side. Pleon distinctly segmented, shorter—telson excluded—than the width of the preceding segment; the lateral margins of each segment are closely applied to the sides and indistinctly defined.

Telson longer than the pleon, three times as long as broad, equal in breadth to the terminal fourth; at this point the sides gradually curve inwards to the evenly rounded setose and slightly crenated extremity.

Eyes distinct, large, yellowish-brown.

Superior antennæ slender, a little shorter than the inferior; first joint stout, twice as long as broad; second joint about half the length and slightly narrower than the first; third joint twice as long as broad, longer than the second; flagellum equal in length to the two preceding joints, consisting of four articulations, of which three are subequal in length but gradually diminishing in diameter to the fourth, which is very small.

Inferior antennæ having the basal joint as long as broad constricted in the middle, with the distal border oblique and slightly dilated; second joint stouter and longer than the first, about one-eighth longer than broad, and much broader than the two following joints which are subequal in size; fifth joint the longest, tapering, twice as long as broad.

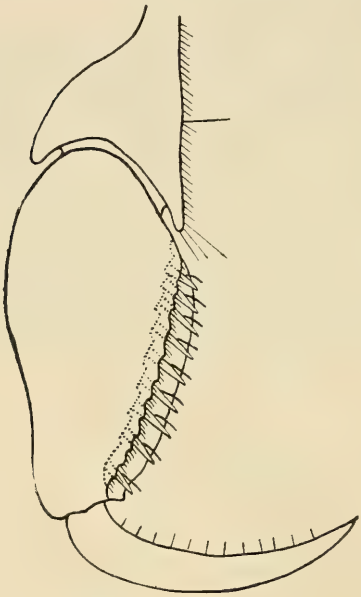
Flagellum consisting of five or six joints, two of which are stoutish and distinct, the rest are minute and scarcely distinguishable. The joints of both pairs of antennæ exhibit a few scattered hairs on their apical borders, and each terminates in a small tuft as long or longer than the flagellum.

First Leg.
Fig. 17*a*.

First pair of legs moderately stout, about one-fifth shorter than the succeeding pair, basos and ischium subequal, merus transversely sublunate, distal border concave with a few setæ on the superior extremity, carpus subtriangular in outline, inferior border minutely ciliate with a few long setæ at the distal end. Propodus ovate-elongate, palmar border double, the inner convex with a row of ten or twelve smooth setæ, the outer slightly concave and produced proximally into a small lobe; the edge carries a row of eight or nine smooth setæ, which are scarcely half the length of those on the inner aspect.

Dactylus curved a little longer than the outer border of the palm; the inferior surface bears nine or ten short equidistant hairs.

Second and third pairs of legs subchelate, basos joint as long as the two following combined; the inferior border is straight, the superior curved, each with a few widely separated hairs; merus subtriangular; inferior border straight, ciliate; superior border oblique and a little curved towards its setose extremity;

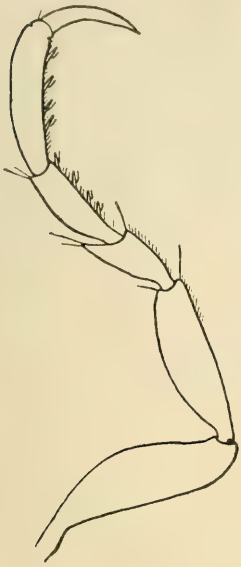


CHELIPEDE OF SECOND LEG.
Fig. 17*b*.

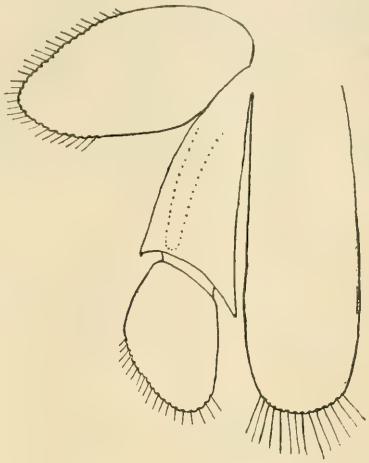
THIRD LEG.
Fig. 17*c*.

distal margin oblique on its lower half and concave on the upper. Carpus longer than wide, its lower border ciliate and nearly equal in length to the preceding joint. Propodus ovate-oblong; superior border convex proximally, tending to become concave at the distal two-thirds. Palmar border two-edged; the outer is convex, smooth and glabrous; the inner is thin, regularly sinuated and minutely ciliate throughout; the intermediate space carries a row of nine stout spines, which arise from bracket-like processes, and are in close contact with the ciliated inner border for about one-fourth of their length. Each spine has the anterior edge finely serrate, and the posterior bears about the middle a slender accessory spinule, which extends to or beyond

the apex of the spine. Fourth to seventh pairs of legs subequal in length, a little more slender than the second and third; the basos joint in the sixth pair is equal in length to the ischium;



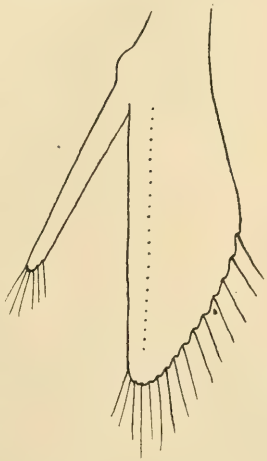
Sixth Leg.
Fig. 17*d*.



Telson and Uropod.
Fig. 17*e*.

merus very narrow proximally, gradually widening to beyond the middle; the distal border is somewhat oblique. Carpus as long but not quite so broad as the merus. Propodus one-third longer than the carpus, of equal breadth throughout, or slightly broader distally. Dactylus gradually tapering, curved and equal to the carpus in length. The third to sixth joints have their inferior borders closely and very finely ciliate; the distal extremities both above and below bear one or more setæ; the fifth and sixth are each armed inferiorly with four spines, structurally like those on the palm of the second and third legs, but not quite so stout.

First pair of pleopods large, concealing the succeeding pairs. Outer ramus sublanceolate, as long as the



First Pleopod.
Fig. 17*f*.

telson, the outer distal half of the margin and the extremity with numerous long setæ, each of which arises from a small notch; inner ramus very narrow, about eight times as long as broad at the base, of nearly equal width to near the blunt apex, which bears six long setæ. The succeeding pairs have both rami foliaceous twice as long as broad, and each with a notch-like constriction at the sides in the middle. Uropods a little shorter than the telson; outer ramus ovate; the margins minutely crenate and sparsely ciliate, equal in length to the first joint of the inner; the latter has the distal border excavated and the angles produced; terminal joint longer than broad, narrower than the first; inner margin straight glabrous; apex and outer margin rounded, slightly crenate and ciliate.

Total length	9·5 mm.
Length of cephalon	0·6 „
„ „ peraeon (breadth between lateral pigmented lines of five segments 0·5) ...	7·5 „
Total length of pleon (telson included) ...	1·6 „
Length of superior antennæ	0·6 „
„ „ inferior „	0·7 „
Total length of first leg	1·85 „
„ „ „ third „	2·15 „
„ „ „ sixth „	2·5 „
„ „ „ pleopod	1 „
„ „ „ telson	1 „
„ „ „ uropod	0·9 „
„ „ „ outer ramus	0·7 „

Four examples obtained off Wata Mooli, in 54-59 fathoms.

PARANTHURA INVOLUTA, sp. nov.

(Figs. 18*a*-*g*.)

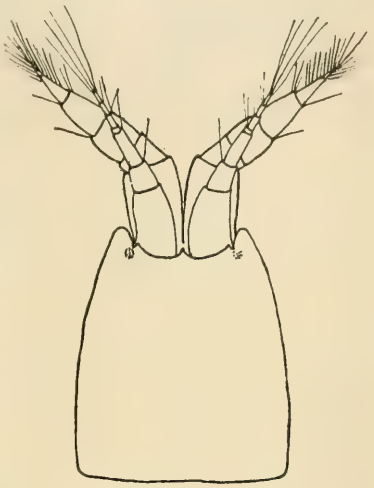
Station 37.

Body elongate, much wider in the middle than at the extremities. Cephalon a little longer than broad, front bisinuate and tridentate; the denticles are equal and their apices are in a transverse line. Sides convex, converging towards the rounded and somewhat produced lateral angles of the front. First segment nearly twice as long as broad, equal in width throughout and to the length of the cephalon. Second longer, slightly

narrowed posteriorly. Third subequal to the second in length, but wider behind than in front. Fourth and fifth subequal, broader and longer than those preceding or following; seventh broader than long, narrower than the sixth.

Upper surfaces of peraeon segments slightly convex from side to side; each dorso-lateral margin has a very faint and somewhat indistinct line; the cephalon is depressed and also exhibits faint marginal lines. Inferior surface of first segment acutely keeled; the under surfaces of the succeeding segments are smooth, convex and without distinctive marks.

Pleon one-fifth narrower than the last segment of the peraeon and three-tenths longer than broad with the telson.

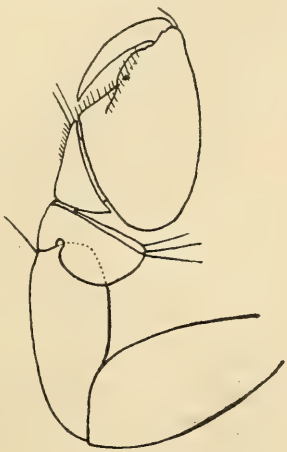


Cephalon and Antennæ.
Fig. 18*a*.

First segment as long as the second and third combined; second to sixth segments subequal in length. Sides of each segment adherent and indistinctly defined.

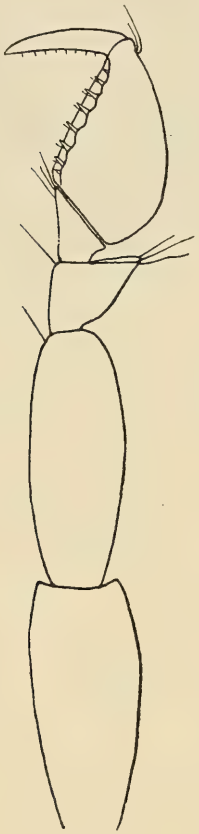
First antennæ having the basal joint twice as long as broad and longer than the second and third combined; third joint nearly twice as long as the second but narrower; flagellum with five articulations, the first and last very short, the three intervening subequal and tapering; each joint bears a few short setæ and the apex two or three long ones.

Second antennæ very stout, somewhat longer than the first; basal joint short, slightly constricted in the middle, second joint about two-fifths longer than broad, third and fourth subequal, fifth longer than broad, sixth narrow, tapering, as long as the fourth and terminating in a dense tuft of short setæ.

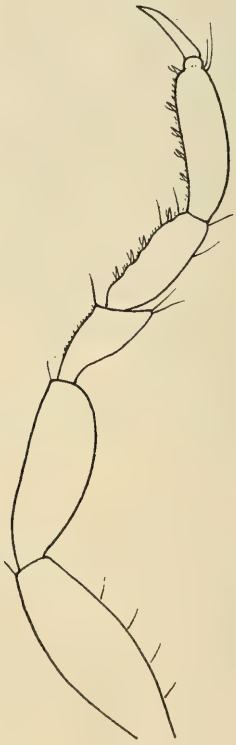


First Leg.
Fig. 18*b*.

First pair of legs moderately short and stout; basos and ischium joints equal in length, but the first named is one-fifth broader. Merus two-fifths longer than broad, with the distal margin straight. Carpus one-fourth longer than broad, the distal margin straight, very oblique and closely applied throughout to the infero-posterior surface of the propodus; the latter is ovate in outline, with an inferior lobe against which the tip of the finger impinges when closed. Palmar border two-edged, one short and convex, the other long and concave; the latter bears about fourteen setæ; there are also a few between the ridges. Finger shorter than the palm, curved, with a few short setæ on the inner edge.



THIRD LEG.
Fig. 18*c*.

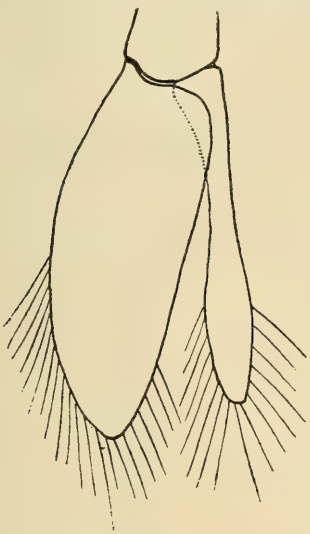


SIXTH LEG.
Fig. 18*d*.

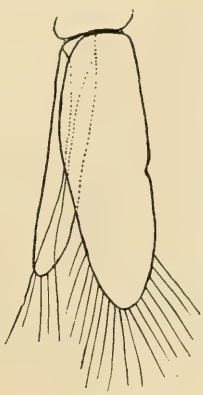
Second and third pairs of legs similar, having the basos joint one-fifth longer than the ischium and about the same broader. Merus one-fourth shorter than the carpus, inferior border straight, superior oblique and evenly curved, distal margin concave, with a few distally situated setæ. Carpus and propodus similar in shape to that of the first, but a little less in size, and the lobe on the palm is wanting. Palmar border armed with eight or nine spines, each of which is indistinctly serrated anteriorly and bears an accessory spinule posteriorly.

Fourth to seventh pairs of legs differing little except in length, the last pair being shorter; all the joints are very similar and subequal in length; the inferior margin of the carpus is armed with four and the propodus with five spines, which are structurally like those on the second and third legs.

First pair of pleopoda large, partially concealing the rest; outer ramus less than three times as long as broad, almost of equal width in the basal two-thirds, thence converging rapidly on the outer margin to a point which bears numerous setæ; inner ramus narrow, a little shorter than the outer, broader at the apex and base than in the middle, the distal third margined with setæ.



First Pleopod.
Fig. 18*e*.

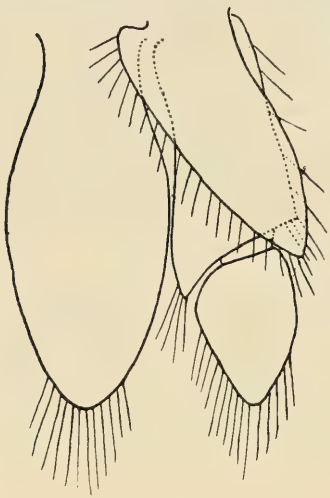


Second Pleopod.
Fig. 18*f*.

Second and succeeding pairs of pleopoda one-fourth to one-fifth shorter than the first; outer ramus three times as long as broad, slightly tapering, margined with a few setæ; inner ramus shorter than the outer, involute and tube-like; the sides almost in contact

in the middle, but separate at the base and apex. The latter is tipped by four or five setæ.

Uropods as long or a little longer than the telson; outer ramus three times as long as broad; outer margin slightly convex, glabrous except at the tip; inner nearly straight, crenate and setose throughout. Basal joint of inner ramus two-fifths longer than broad; margins straight, the inner glabrous, the outer setose; distal border oblique, slightly produced at the inner angle. Terminal joint twice as long as broad, outer margin evenly curved, inner strongly convex, especially at the base, both bearing numerous setæ.



Telson and Uropod.
Fig. 18*g*.

Telson lanceolate, constricted near the base, widening out at the middle, and thence gradually converging to the rather narrow, rounded, sparsely setose extremity.

Colour, pale creamy-white.

One example, obtained off Botany Bay, in 50-52 fathoms.

Total length of body	11 mm.
Length of cephalon	0·75 mm.
Breadth of ,, ...	0·6 ,,
Length of 1st segment of peraeon ...	1· ,,
Breadth of 1st ,, ,, ...	0·55 ,,
Length of 2nd ,, ,, ...	1·3 ,,
Breadth of 2nd ,, ,, ...	0·6 ,,
Length of 3rd ,, ,, ...	1·2 ,,
Breadth of 3rd ,, ,, ...	0·75 ,,
Length of 4th ,, ,, ...	1·5 ,,
Breadth of 4th ,, ,, ...	0·9 ,,
Length of 5th ,, ,, ...	1·55 ,,
Breadth of 5th ,, ,, ...	1·0 ,,
Length of 6th ,, ,, ...	1·2 ,,
Breadth of 6th ,, ,, ...	1·0 ,,
Length of 7th ,, ,, ...	0·6 ,,
Breadth of 7th ,, ,, ...	0·8 ,,
Length of pleon	0·8 ,,
Breadth of ,, ...	0·6 ,,
Telson and seventh segment	1·0 ,,
Length of outer ramus of uropod... ...	0·55 ,,

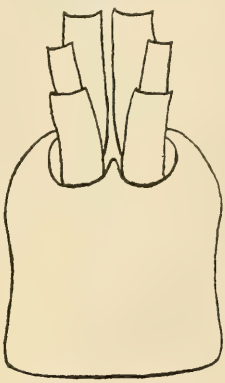
CALATHURA, *Norman and Stebbing.*

CALATHURA GIGAS, sp. nov.

(Figs. 19*a-e.*)

Station 34.

Body moderately stout, elongate. Cephalon a little broader than long; front bisinuate with a short, median rostriform process; the antero-lateral angles are rounded and project on each side so as to embrace the outer bases of both pairs of antennæ; sides rounded, faintly concave about the middle.



Frontal Region.
Fig. 19*a.*

First peraeon segment closely united to the cephalon; it exceeds the latter in breadth and is twice as long; the anterior margin is straight, the sides concave, laterally arched, and somewhat angular, especially anteriorly.

Second to sixth segments agreeing closely with the same segments in *Calathura brachiata*, Stimpson, the median depressions being, perhaps, a little less marked.

Seventh segment broader than long, with a prominent lobe on each postero-lateral angle. The lobes extend over and beyond the first segment of the pleon.

Superior surface of cephalon and first three segments of peraeon more or less convex, succeeding segments somewhat flattened. Inferior surface of first peraeon segment with a blunt longitudinal keel, the second strongly but roundly convex; the five segments following have the lower surface flattened; the sides are defined by a distinct ridge; mesially there is a narrow longitudinal groove which marks the inner limits of a series of transverse corrugations; the latter are much more distinct in the male than in the female.

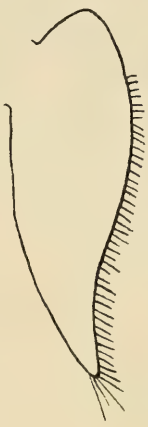
Pleon less than twice as long as the last segment of the peraeon. Segments well defined, becoming wider posteriorly; first longer than the second, third and fourth, but shorter than the fifth. Lateral margins obliquely truncated, rather pointed posteriorly.

First pair of pleopods nearly equal in length to the pleon and telson combined; the outer ramus is narrow, oblong and becomes

slightly wider beyond the middle; the inner margin is straight and the outer curved; the apex is obtusely rounded and strongly ciliated.

Uropods as long or longer than the pleon; outer ramus more than three times as long as broad, gradually tapering to a subacute point; in outline the inner margin and the proximal two-thirds of the outer is slightly convex, whilst the distal third is concave; first joint of the inner ramus one-fourth longer than the outer and four times as long as broad at the extremities; second joint a little less than three times as long as broad at the base, gradually tapering to half its basal width at the obtusely rounded, setose extremity.

Outer Ramus of Uropod.
Fig. 19*b*.



Inner Ramus of Uropod.
Fig. 19*c*.

Telson equal in length to the pleon, lanceolate, suddenly narrowed distally to a subacute point.

Eyes undistinguishable, destitute of pigment.

Superior antennæ having the peduncle (in situ) equal in length to the first two joints of the inferior antennæ; when detached and placed side by side the peduncle exceeds the two joints by about 0·5 mm. Basal joint stout, two and a half times as long as broad, longer than the two following subequal joints combined. Flagellum more than twice as long as the peduncle, consisting of twenty-eight articulations, first joint* broader than long, second one-fourth longer than broad, third to sixth broader than long; the remaining joints gradually increase in length, and the distal ones are two or three times as long as broad; there are a few long setæ on the terminal joint of the peduncle and the flagellum bears one or two short hairs on the inner apical angle of each articulation.

Inferior antennæ having the peduncle equal in length to the flagellum of the superior. Basal joint as broad as long, constricted in the middle and dilated distally, second stout, twice as long as broad, third a little longer than broad, with distal border

* Structurally this joint appears to be like a fourth joint of the peduncle.

oblique and produced on the inner side, fifth longer than the fourth and three times as long as broad. Flagellum equal in length to the first four joints of the peduncle, consisting of thirty-four stoutish, subequal joints, each of which is furnished at its apex on one side with a row of from six to twelve, or more, strong setæ; a few scattered weaker ones are present here and there on the opposite side.

The flagellum of the superior antennæ in the male consists of thirty-six articulations, the first three of which are normal and bear a few stiff setæ inferiorly; the succeeding twelve joints are greatly swollen and covered below and at the sides with a dense coating of woolly hairs; the remaining twenty-one joints are from twice to thrice as long as broad, and each bears at the distal extremity one or two short setæ.

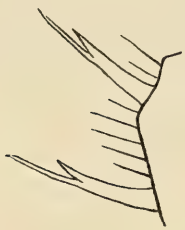
The mouth organs do not differ materially from those of *Calathura norvegica*, as figured by G. O. Sars. The mandibles, however, seem relatively larger and the palps somewhat smaller; the first maxillæ do not exhibit any trace of hairs below the serrations, and the second maxillæ appear to be absent. The lower lip is keeled externally on the proximal half and exhibits a tuft of hairs on either side internally which arise from near the base and reach almost to the apex.

Right Chelipede.
Fig. 19*d*.

First pair of legs stout, the right slightly the larger, having the basos joint a little shorter than the ischium, and more than twice as wide distally as proximally; merus dilated, much broader than long, and adapted to the posterior base of the hand; the latter is sublanceolate in shape, and three times as long as broad; the inferior edge of the palm is slightly convex, and has a conical lobe at the base; the edge, lobe and inferior border of the carpus bear numerous stout spine-like setæ, each of which is covered distally with exceedingly minute hairs.

Superior palmar border evenly convex, and about one-third longer than the lower; dactylus slender, distally curved, its tip reaches to the base of the conical lobe when closed; the inferior border bears a line of short but scarcely tapering setæ.

The second and third pairs of legs differ from the first in being comparatively slender, and in having the meral joint subtriangular in outline and longer than broad; the inferior border and the superior distal extremity bear a few long setæ; the distal margin is excavated and adapted to the base of the hand and the carpus. The shape of the palm is much like that of the first pair, but the basal lobe is wanting, the setæ are longer, and the inferior edge bears about ten stoutish spines, the distal two or three have on each side one or two accessory spinules, the remainder have one only, which is situated on the posterior border, arising about the middle and continued beyond the apex of its support. The dactylus is scantily hairy throughout its length, and has a tuft at its tip.



Spines on Border of Palm of Second Leg.
Fig. 19*e*.

Fourth, fifth and sixth pairs of legs subequal, the seventh pair somewhat shorter. Each carpal joint is armed below with four or five equidistant spines, and some long setæ; the spines increase in length as the distal extremity is approached, where they are nearly as long as the transverse diameter of the joint. The propodal joints of the fourth and fifth pairs of legs bear eight or nine spines, and those of the sixth and seventh pairs from eighteen to twenty. All the spines of the carpo-propodal joints have a long accessory spinule. Dactyli slender, curved, about one-fifth shorter than the preceding joint.

Total length of body	42	mm.
Length of cephalon	2·5	,,
,, ,, peraeon	31	,,
,, ,, pleon without telson	3·5	,,
,, ,, telson	4·5	,,
,, ,, uropod	6	,,
,, ,, ramus	4	,,
,, ,, ramus	5·5	,,
,, ,, first antennæ	6	,,
,, ,, peduncle first antennæ	2	,,
,, ,, second antennæ	6·5	,,
,, ,, peduncle second antennæ... ...	3·8	,,

Length of first leg (finger excluded)...	...	9	mm.
,, ,, second leg (finger excluded)	...	8·5	,,
,, ,, fourth ,, ,, ,,	...	10·5	,,
,, ,, seventh ,, ,, ,,	...	9	,,

Four examples, including one male, obtained off Port Jackson in 36-39 fathoms.

Family ÆGIDÆ.

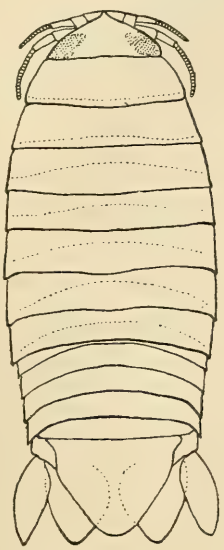
ÆGA, *Leach.*

ÆGA AUSTRALIS, sp. nov.

(Fig. 20*a-f.*)

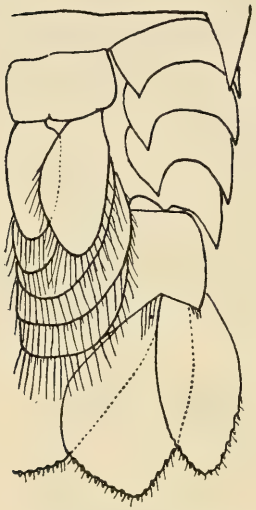
Station 44.

Body somewhat elongate, about two and a half times as long as broad, slightly tapering from the middle towards both extremities, the pleon a little narrower than the peraeon. Cephalon twice as broad as long, with a well defined rostral process, which is as long as broad at the base, and completely separating the inner bases of the first antennæ; inner frontal margins oblique, outer slightly convex. Peraeon segments subequal in length, shorter than the cephalon, with the rostrum included, the first and fifth slightly longer than the others; surface strongly convex from side to side; the usual transverse grooves are distinctly defined on all the segments; on the first and second the grooves are situated near the posterior margin, whilst those on the remaining five are near to or in advance of the centre. The epimera in all the examples except one — a gravid female—are invisible from above; the curved ridges are somewhat ill defined. The posterior epimeral border of the second and third segments is obliquely truncated, with rounded

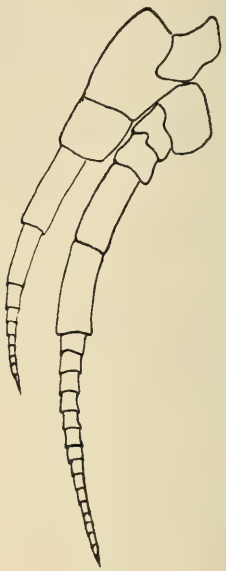


BODY VIEWED FROM ABOVE.
Fig. 20*a*.

corners, the upper corner being slightly longer than the lower; the posterior border of the fourth is transverse, with the lower angle subacute; in the two following the lower angle becomes more produced and the upper obliquely curved; the seventh is very acute, and one-third longer than broad. Pleon segments subequal in length, with the posterolateral angles of the first four acutely produced, the fifth being somewhat rounded.



POSTERIOR REGION OF BODY VIEWED FROM BELOW.
Fig. 20*b*.



RIGHT ANTENNÆ.
Fig. 20*c*.

Telson more than one-fifth wider at the base than long, sides converging to the obtusely rounded extremity; surface very slightly convex; distal margin uneven, with a few small spines and setæ. Eyes small, subtriangular, longer than broad, with their inner acute angles separated by a space about equal to the length of the cephalon without the rostrum.

First antennæ having the first two joints very broad, with their anterior margins produced into thin acute edges, flagellum consisting of nine or ten articulations and about equal in length to the peduncle; second antennæ one-third longer than the first, with the peduncle as long or longer than the flagellum; the latter consists of about sixteen articulations.

The mandible is strikingly like that of *Rocinela danmonensis*, as figured by G. O. Sars.* The remaining appendages of the

* Sars—Crust. of Norway, ii., 1897, p. 65, pl. 27, M.

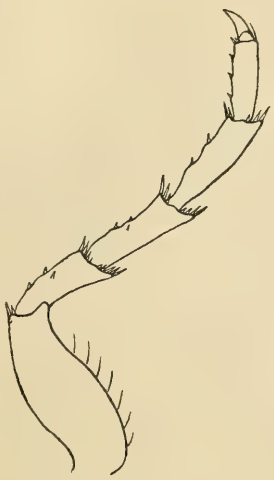
mouth closely agree with those of *Æga psora*, as figured by Sars on pl. 24. The maxillipedes have six well defined joints; the seventh if present is very small.

First pair of legs the shortest, and somewhat less robust than the two following pairs; basos joint of the first a little more than twice as long as broad, with a sharply defined ridge on the external surface, terminating distally in a prominent rounded lobe. Ischium joint with a small superior distal lobe tipped by a spine; both the lobe and the spine are greatly developed on the same joint of the second and third legs. Merus of the first leg unarmed, the second and third with two or more spines on both upper and lower distal extremities, and three or four on the middle portion of the lower border. Carpus armed with one spine inferiorly and the propodus with two.

Mandible.
Fig. 20*d*.

Second Leg.
Fig. 20*e*.

Fourth to seventh pairs of legs very similar. The superior and inferior distal extremities of the ischium, merus and carpus of the sixth are armed with a fringe of from six to twelve spines; the lower borders also carry two or more moderate spines, with one or two small accessory spinules on either side in the same transverse line. A row of similar spines and spinules occurs on the lower border of the propodus. Pleopods densely fringed with longish hairs. Outer ramus of the first pair longer and broader than the inner. Uropods projecting slightly beyond the telson. Outer ramus shorter and much narrower than the inner;



Sixth Leg.
Fig. 20*f*.

both rami have their distal borders crenate, spinose and sparsely ciliated.

Total length of body	12 mm.
Length of cephalon	1·5 „
Breadth of cephalon	2·3 „
Length of peraeon	6·5 „
Greatest breadth at the fifth segment ...	4·5 „
Length of pleon	2·3 „
„ „ telson	2·1 „
„ „ first leg	3 „
„ „ sixth leg	6 „

Colour.—Body yellowish-white, uniformly spotted with dark brown.

Four examples were obtained at Station 44 off Coogee Bay, in 49-50 fathoms.

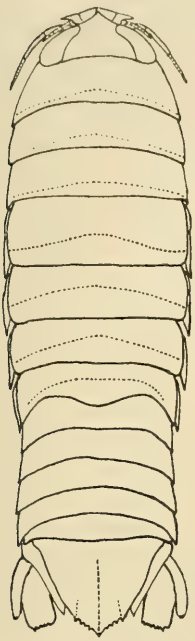
ÆGA ANGUSTATA, sp. nov.

(Fig. 21*a-f.*)

Station 57.

Body evenly punctate, narrow, elongate, nearly three times as long as broad without the telson. Cephalon more than twice as broad as long, acutely pointed in the middle and evenly rounded at the sides. First segment a little shorter than the cephalon, slightly longer than the second and third, which are equal, and are each as long as the fifth and the sixth ; fourth segment much the longest, twice as long as the seventh. Epimera of the first three segments evenly rounded posteriorly, the lower border of each bears a small subterminal lobe ; fourth, fifth and sixth subacute ; the lower border convex in the anterior half, and straight posteriorly ; seventh somewhat obtuse, with the upper and lower terminal borders oblique. Pleon segments subequal in length, the fourth and fifth slightly wider than the first and second ; posterior lateral angles short and subacute. Telson broader than long, equal in length to the first four segments of the pleon ; the upper surface bears an ill-defined median and a pair of lateral ridges ; the latter are confined to the distal fourth, and rather indistinct ;

distal border dentate, spinose and sparsely setose. Eyes oblong, separated mesially by a space equal to their width; the ocellæ are visible on the inferior margins of the cephalon.

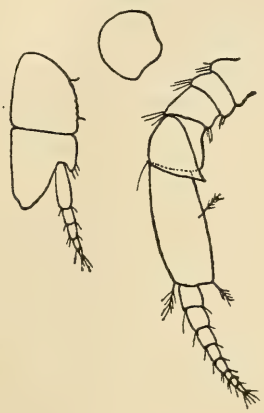


Body viewed from above.
Fig. 21*a*.

Superior antennæ with the peduncle strongly compressed; the second joint equal in length to the first, produced superiorly into a prominent subacute lobe; third joint very narrow, its length not equal to the width of the second; flagellum subequal to the preceding joint, and consisting of four articulations. Peduncles of second antennæ compressed; first and second joints equal; fourth a little longer than third, with a superior acute lobe directed outwards and backwards; fifth joint equal in length to the four preceding, and as long as the eight-jointed flagellum.

Second joint of the palp of the mandible twice as long as the first.

First pair of legs stout, shorter than the second or third; basos joint twice as long as broad; merus much broader than long; palmar border of hand with a slight setiferous tubercle; dactylus very stout and strongly curved.



Antennæ and Epistomial Plate.
Fig. 21*b*.

Basos joint of third pair of legs more than twice as long as broad; ischium with two spines at the lower distal angle; merus slightly longer than broad, with four spines on the lower border and two at the upper distal angle. Carpus equal in length but a little broader than the propodus; the inferior distal extremity of the latter carries a large finger-like process; the dactylus is curved and somewhat twisted in its distal half, the lower edge

being adapted to the upper border of the process. Structurally the process is similar to that found in *Ægа crenulata*, Luken*, but it is much more strongly developed in the species under notice. Fourth to seventh pairs of legs very similar; the sixth has

First Leg.
Fig. 21*c*.

Third Leg.
Fig. 21*d*.

the basos joint a little less than three times as long as broad, with a single spine at the lower distal extremity; ischium joint narrow at the base, and more than twice as long as broad at the summit; lower border with four equidistant spines, the one in the middle being very much larger than the others; upper and lower distal margins fringed with long spines. Merus twice as long as broad, and one-third shorter than the preceding joint; lower border and distal margins armed with spines, some of which are longer than the joint is wide. Carpus longer and much narrower than the merus, armed like the latter, but the spines are fewer and somewhat smaller. Propodus longer than the carpus, its greatest breadth is at the distal extremity, and is about one-sixth of its length; the lower border carries three spines, two near the middle, and one distal. Dactylus slender, curved thrice as long as the breadth of propodus.

Inner border of peduncle of first pleopods armed with four or five strong curved spines. Outer ramus very broad towards the base; lateral margins slightly converging from about the middle to the obtusely rounded apex; inner ramus shorter than the outer, more than twice as long as broad, truncated at the inner base, and subacute at the apex.

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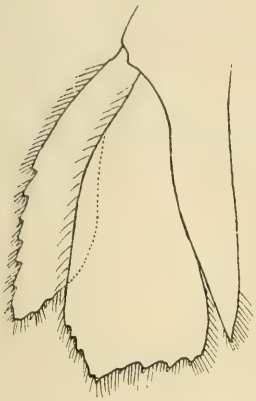
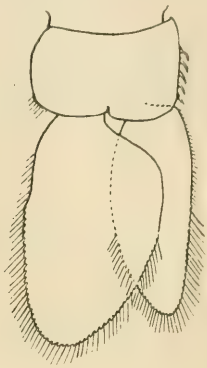
* Sars.—Crust. Norway, ii., 1897, p. 61, pl. 25, f. 3.

Uropods shorter than the telson ; outer ramus narrow, subacute, serrate, spinose and ciliate ; inner ramus becoming wider towards the truncate-serrate extremity.



Left Uropod.
Fig. 21*e*.



First Pleopod.
Fig 21*f*.

Total length of body	...	...	...	15	mm.
Breadth	...	...	...	4·5	,,

A single example was obtained off Wata Mooli, in from 54-59 fathoms.

Family CYMOTHOIDÆ.

NEROCILA, *Leach.*

NEROCILA LATICAUDA, *Schiœdte and Meinert.*

Nerocila laticauda, Schiœdte and Meinert, Monogr. Cymothoarum, 1879, p. 81, pl. vi., figs. 14-15.

Stations 13, 37 and 42.

Five examples of this well marked species are in the collection.

The first antennæ are longer and stouter than the second ; the latter have nine joints and the former eight.

The body exhibits three longitudinal brown bands, one median and two lateral.

Off Cape Three Points, Wata Mooli and Botany, in 41-78 fathoms.

LIVONECA, *Leach.*

LIVONECA RAYNAUDII, *H. Milne-Edwards.*

Livoneca raynaudii, H. Milne-Edwards, Hist. Nat. Crust., iii., 1837, p. 262.
Lironeca novæ-zealandiæ, Miers, Ann. Mag. Nat. Hist., (4) xvii., 1876, p. 228. Miers, Crustacea of New Zealand, 1876, p. 106.

Stations 2,-38, 42.

Total length of large specimen	...	...	38 mm.
„ „ small „	...	...	17 „

Seven examples of this species were obtained off Cape Three Points, Jibbon, and Wata Mooli, in 32-78 fathoms.

Family SEROLIDÆ.

SEROLIS, *Leach.*

SEROLIS TUBERCULATA, *Grube.*

Serolis tuberculata, Grube, Archiv. f. Naturgesch., 1875, p. 227, pl. v. Beddard, Chall. Report, Zool., xi., 1884, p. 67, pl. vi., figs. 1-2.

Station 33.

The specimen is about one-third less than the "Challenger" example from Bass' Strait, and differs considerably in the surface sculpture. This, however, may be due to age. The cephalic shield exhibits thirteen tubercles; five form a transverse row between the anterior margin of the eyes, and there are two longitudinal submedian rows of four each, arranged in curved lines, the first and last pairs being wider apart than those in the centre. A median dentiform tubercle is present on the posterior border of the shield; in size it is equal to the largest of the median processes of the peraeon. The mesial pleon tubercles bear several smaller tubercles on each side. The epimeral processes and the inner rami of the uropods carry three or four small tubercles. The telson exhibits numerous flat, scale-like bodies; the central keel has six or more on each side, and there is a very distinct series of about fourteen arranged transversely

in a line with the insertion of the uropods ; posterior to this line the telson is thickly studded with scales, and towards the sides they are subimbricate.

The postero-lateral angles of the first, second, third and fifth epimera are in close contact with the antero-external surface of the next following.

The flagellum of the first antenna consists of fifty-six articulations and the flagellum of the second of seventeen.

Length of specimen	...	...	...	...	14 mm.
Breadth „	...	...	...	...	11 „

A single male example was obtained in the Newcastle Bight at a depth of 24-27 fathoms.

SEROLIS AUSTRALIENSIS, *Beddard.*

Serolis australiensis, Beddard, Chall. Rep., Zool., xi., 1884, p. 69, pl. vi., figs. 3-8.

Station 36.

The incubatory pouch contains numerous young in various stages of development, varying from 2 to 3 mm. in length. The cephalon is quite distinct, and the forwardly directed lateral processes of the first peraeon segment are situated at some distance from sides of the cephalon. The eyes are marginal and exhibit a sharp posterior inward curve marking the juncture of the cephalon with the peraeon.

Total length of adult female	...	...	...	...	18 mm.
Breadth „	„	...	...	...	13 „

A solitary female example of this species was procured off Botany Bay, in 20-23 fathoms.

SEROLIS ELONGATA, *Beddard.*

Serolis elongata, Beddard, Chall. Rep., Zool., xi., 1884, p. 71.

Station 13.

A single much damaged male of this species is in the collection. It was obtained off Cape Three Points in 41-50 fathoms. The specimen is 8 mm. in length and 5 mm. in breadth. It fully agrees with the description and bears a striking resemblance to *Serolis australiensis*, but is much smaller, less granulose, and longer in proportion to its width.

SEROLIS PALLIDA, *Beddard.*

Serolis pallida, Beddard, Chall. Rep., Zool., xi., 1884, p. 75, pl. vii., fig. 1 ; pl. viii., figs. 6-16.

Station 13.

One adult male of this species was obtained off Cape Three Points, in 41-50 fathoms.

Total length	11 mm.
Breadth	8 ,,

SEROLIS LONGICAUDATA, *Beddard.*

Serolis longicaudata, Beddard, Chall. Rep., Zool., xi., 1884, p. 72, pl. vii., figs. 8-10 ; pl. viii., figs. 1-2.

Station 38.

A single female example was obtained off Jibbon, in 46-55 fathoms.

Total length	4·2 mm.
Breadth	3·9 ,,

SEROLIS MINUTA, *Beddard.*

Serolis minuta, Beddard, Chall. Rep., Zool., xi., 1884, p. 72, pl. vii., figs. 2-6.

Station 38.

Of this species a single male example was obtained off Jibbon, at a depth of 44 to 55 fathoms.

Total length	4·5 mm.
Breadth	4· ,,

Family SPHÆROMIDÆ.

CASSIDINA, *H. Milne-Edwards.*

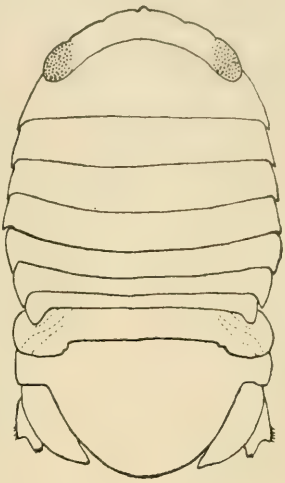
CASSIDINA LATICAUDA, sp. nov.

(Figs. 22*a-e.*)

Stations 44, 48, 55.

Body moderately convex from side to side, closely and minutely punctate, glabrous, smooth and glossy. Very broad in proportion

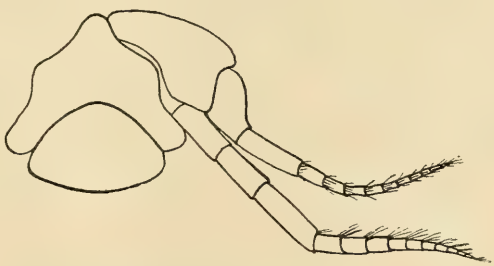
to its length, the ratio being 6·7 : 11. Cephalon strongly deflexed in front, three times as broad as long. Frontal margin bisinuate, with a short median rostriform process, apically rounded, and a little longer than broad. First peraeon segment equal in length to the cephalon and basal antennal joints combined. Second and third a little more than half the length of the first; the fourth, fifth, sixth and seventh gradually decreasing in length; the fourth is half and the seventh one-sixth the length of the first. Epimeral processes of the first three segments directed slightly backwards with thickened margins, oblique sides and somewhat obtuse extremities. Epimera of the fourth segment gradually narrowing to a subacute point; the posterior border is straight, the anterior oblique; the epimera of the three remaining segments are broader distally and less inclined backwards than the three preceding, and the extremities are more obtusely rounded. First pleon segment a little shorter than the fourth segment of the peraeon, lateral margins broad and evenly rounded; the lines of the coalesced segments are very faintly indicated. Telson nearly twice as broad as long, upper surface strongly convex and smooth, the distal border wide and evenly rounded. Inferiorly the sides are folded and longitudinally ridged.



Body viewed from above.
Fig. 22*a*.

Eyes oval, very dark brown in colour.

Superior antennæ having their inner bases separated above by the frontal process and below by the apex of the epistomial plate, basal joint equal in length to the two following combined. Flagellum with ten articulations,



Frontal Region and Antennæ.
Fig. 22*b*.

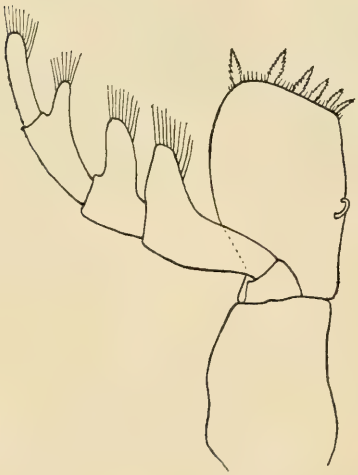
much shorter than the peduncle, each joint distally encircled with short setæ.

Inferior antennæ having the first three joints subequal, the fourth much the longest. Flagellum consisting of ten joints, about equal in length to the first three joints of the peduncle; the summits of the joints are furnished with numerous long tufted hairs.

Body of mandible stout, bent inwards at about the upper third, cutting edge strongly dentate, subtended below with twelve or more curved denticulated spines, molar tubercle well developed, with a subterminal fringe of short spines. Palp short, with three subequal joints.

Outer lobe of first maxillæ armed at the apex with about ten strong, curved, denticulated spines, which are longer than the width of the lobe. Inner lobe about half the size of the outer, furnished at the obliquely truncated summit with four stout, pectinated spines.

Second maxillæ with three lobes, each about twice as long as broad, nearly equal in length and breadth; apices truncated, the outer pair



RIGHT MAXILLIPEDE.
Fig. 22*c*.

FOURTH LEG.
Fig. 22*d*.

surmounted with smooth, flat, cultrate spines, whilst the odd inner lobe bears numerous minutely serrated spines and one large pectinated spine.

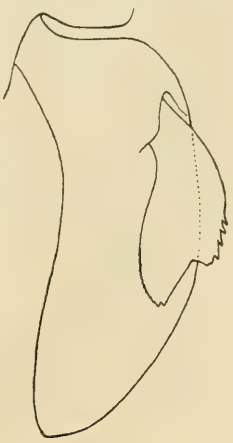
Maxillipedes with the first joint shorter than the second; the latter is rather broad, truncated distally, and armed with six flat pectinated spines and numerous shorter simple ones; the infolded inner border bears a blunt hook-like process about the middle and four flat spines at the summit.

Superior distal extremities of the second, third, and fourth joints of the palp strongly lobate; the tip of each lobe and of the cylindrical fifth joint is furnished with a number of long simple setæ.

Legs rather slender, the posterior pairs longer than the anterior; basos joint of the first pair as long as the three joints following combined; ischium rather longer than the merus and carpus; propodus equal in length to the two preceding joints and twice as long as the bispinose dactylus; each inferior propodal border of all the legs with four more or less pectinated spines; meral and carpal joints with three or fewer spines on the lower border, and a fringe of large strongly pectinated spines on the distal margin above.

Rami of the first pair of pleopods foliaceous, subequal in size, nearly twice as long as broad; distal and external borders with long plumose setæ; inner ramus rather acutely produced at the outer base.

Uropods not reaching to the end of the telson; fixed joint subfalcate, twice as long and broad as the mobile ramus; the latter has four denticles on its outer border and two at the distal extremity.



Uropod.
Fig. 22*e*.

Colour in spirits pale cream.

Fourteen examples obtained off Coogee, Wollongong, and Crookhaven River, at depths varying from 11 to 56 fathoms.

Total length of larger example	...	...	11	mm.
Breadth „ „ „	...	...	6·5	„

CASSIDINELLA, gen. nov.

Body oblong, convex, less than twice as long as broad, with the segments laterally incised, some of which are quite distinct and separated from each other. Cephalon dorsally short and produced vertically downwards in front. Segments of the

peraeon unequal, the first much the longest. Epimera acute, widely separated from each other, and their union with the lateral tergal margins indistinct. Pleon much narrower than the peraeon, consisting of two segments, with well developed epimera on the first of the coalesced segments. Terminal segment large, with a lateral pair of epimera-like processes and a tridentate distal border.

Eyes round, widely separated, lateral and prominent.

Superior antennæ with the basal joints dilated; the flagellum shorter than the peduncle.

Inferior antennæ with a slender cylindrical peduncle, a little shorter than the flagellum.

Mandibles stout, cutting edge terminating in two or three blunt denticles, subtended below with a tuft of simple spines. Molar tubercle broad, short, with a few subterminal spines.

Palp three-jointed.

Anterior maxillæ with the masticatory lobe somewhat narrow, tipped with curved simple spines; basal lobe furnished at the apex with four unbranched filaments.

Posterior maxillæ three-lobed, the masticatory lobe rather broad and carrying numerous pectinated spines at the summit; paired lobes narrow, surmounted apically with simple spines.

Maxillipedes slender, basal part rather narrow; masticatory lobe with a blunt curved filament on its inner border and a series of pectinated spines at the summit; palp consisting of five joints, the first short, second to fourth each with a large superior setiferous lobe, fifth subcylindrical and apically setose.

Anterior pair of legs shorter and stouter than the posterior; dactylus of all the pairs with a small secondary subterminal claw.

Pleopoda foliate; all except the last pair densely ciliate.

Uropods short, with the mobile ramus minute.

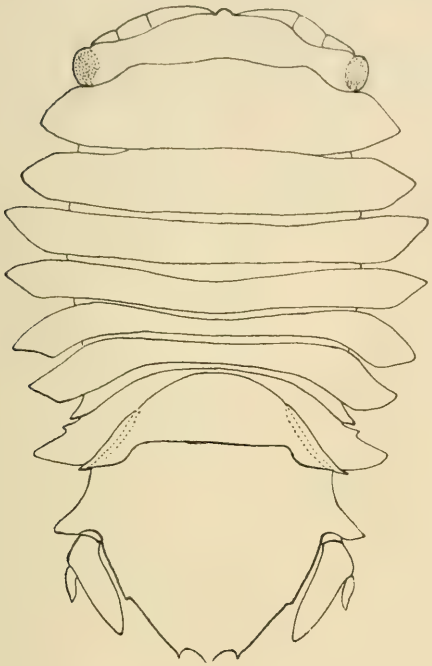
CASSIDINELLA INCISA, sp. nov.

(Figs. 23*a-g*.)

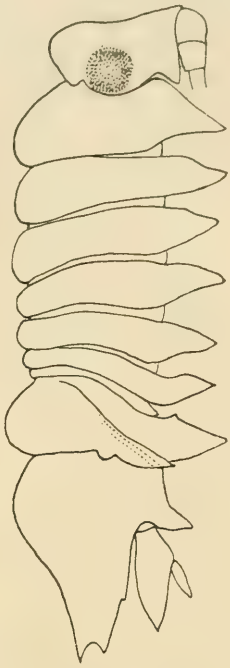
Station 55.

Body less than twice as long as broad, narrowing rather rapidly from the fifth peraeon segment to the end of the telson. Central region of segments transversely and longitudinally convex.

Cephalon from the dorsal aspect about five times broader than long; viewed from the side the front is nearly vertical, as long



BODY VIEWED FROM ABOVE.
Fig. 23*a*.



BODY VIEWED FROM THE SIDE.
Fig. 23*b*.

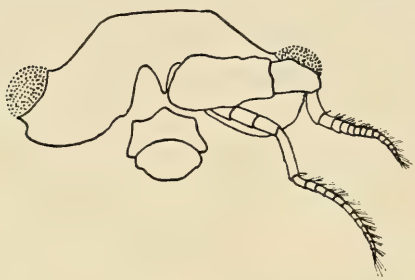
as the succeeding segment, and is slightly concave in front of the eyes. A small frontal median process separates the inner bases of the first antennæ; it is bounded on each side by a deep sinus; the lateral frontal borders are evenly rounded. First segment of the peraeon nearly as long as the two following; second to sixth gradually becoming shorter. seventh segment very short. Third, fourth and fifth segments more or less separated from each other throughout their breadth; first and second separated at the sides; the sixth and seventh have their opposed borders of the terga in contact throughout their breadth. Epimera widely separated from each other, all more or less acute. The lines of union between the terga and epimera are very ill-defined.

The anterior portion of the pleon exhibits slight lateral traces of three segments, the first having a large epimeral process with a small denticle on the base of the anterior border.

Telson strongly convex above superiorly and about one-third the length of the body, with a projecting bracket-like lobe on each side, at about the anterior third; posteriorly the sides are converging and bear a pair of small denticles and three somewhat larger at the extremity; the median denticle extends a short distance beyond the lateral ones. Inferiorly the telson is strongly concave, the margin is slightly thickened but not folded inwards. The last pair of pleopods is operculate in character and adapted to the walls of the telson.

Eyes black, round, and very prominent.

Superior antennæ with the first two joints dilated; the first is curved and nearly twice as long as the second; third joint cylindric, geniculate and shorter than the second; flagellum consisting of about thirteen articulations, each furnished superiorly with numerous slender hairs.



FRONTAL REGION AND ANTENNÆ.
Fig. 23*c*.

Inferior antennæ a little longer than the superior. Joints of the peduncle narrow, cylindrical, the last much the longest; flagellum with about twelve articulations, each with a few short setæ on the superior distal border.

Mandibles stout, cutting edge with two or three obtuse teeth, and a tuft of simple spines at the base; molar tubercle large, but not well defined, with a few indistinct subterminal spines. Palp consisting of three subequal joints.

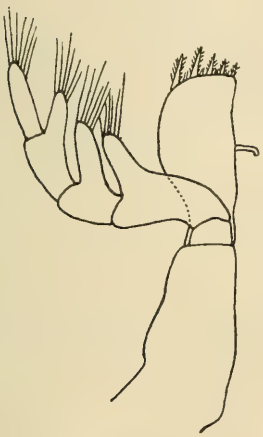
MANDIBLE.
Fig. 23*d*.

First maxillæ as long as the mandible; outer lobe about five times as long as broad, tipped with ten stoutish curved spines; inner lobe very narrow, nearly equal in length to the outer, furnished at the summit with four blunt spines, the inner pair being longer and stouter than the outer.

The second maxillæ have the paired lobes narrow, about four times as

long as broad, their apices carry a few simple acute setæ; the odd lobe is proportionately broad, and has a few marginal hairs and many stoutish pectinated setæ at the oblique distal extremity.

Maxillipedes slender, the basal portion about equal in length but slightly narrower than the distal lobe; the latter has a strongly recurved inner margin, which bears about the middle a single curved blunt seta; the apex of the lobe carries eight stout pectinated setæ, of which three are on the recurved portion of the distal margin; basal joint of palp short; second to fourth joints with a long superior seta tipped lobe; fifth joint cylindrical, surmounted with setæ, longer than the fourth, and about two-thirds as long as the second.



MAXILLIPEDE.
Fig. 23*e*.

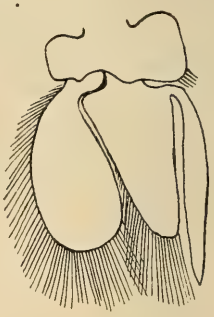
FIRST AND FIFTH LEGS.
Fig. 20*f*.

First pair of legs stout, shorter than those succeeding; basos joint as long as the two following joints combined; ischium longer than the merus, the superior border angulated above the middle. Merus broader than long, with three stout spines on the inferior border. Carpus very short, equal in length and breadth, with two spines on the lower border. Propodus nearly twice as long as broad, and almost equal in length to the ischium; upper border evenly curved, lower with three spines. Dactylus slightly curved, shorter than its supporting joint, with a short subterminal spine, and one or two setæ.

Second to seventh pairs of legs very similar. The fifth pair of legs has the second to the fourth joints proportionately like those of the first, except that they are more slender, and the ischium has a stout seta on the superior angles, and two instead of three spines on the inferior border.

Carpus a little shorter than the ischium, and much shorter than the propodus; the latter joint bears three spines on the lower border and the former two; the distal extremities of the joints frequently bear one or more plumose setæ.

Inner ramus of first pair of pleopods elongate and subtriangular. Outer ramus narrowly obovate. Rami of succeeding three pairs slightly larger and broader. The inner rami of the second pair are each furnished with a fusiform stylet, about one-third longer than the ramus.



Second Pleopod.
Fig. 23*g*.

Uropods rather small, arising from bracket-like processes, situated at about the upper third of the lateral margins of the telson. Fixed ramus three and a half times as long as broad, and half as long as the telson, equally tapering from the distal third to the acute extremity. Mobile ramus minute, slightly curved, narrow and acutely pointed, its length equal to the breadth of the fixed branch.

Total length	8 mm.
Breadth	4 „

One specimen obtained off Crookhaven River, in 43-66 fathoms.

12,009.

AUSTRALIAN MUSEUM, SYDNEY.

MEMOIR IV.

SCIENTIFIC RESULTS

OF THE

TRAWLING EXPEDITION

OF

H.M.C.S. "THETIS,"

OFF THE COAST OF NEW SOUTH WALES,

IN

FEBRUARY AND MARCH, 1898.

PART 4.—Published 25th June, 1902.

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CRUSTACEA.

PART III.

By THOMAS WHITELEGGE,

Zoologist, Australian Museum.

ISOPODA.

Part II.

SEP 3 1902

CRUSTACEA.

PART III.

By Thomas Whitelegge,

Zoologist, Australian Museum.

ISOPODA.

Part II.

The present part deals with the remainder of the family Sphæromidæ. Of the sixteen species herein enumerated, seven belong to known forms and nine are described as new, including one new genus. The new species are as follows :—

Sphæroma australis.
,, *latifrons.*
,, *plumosa.*
Cymodoce inornata.
Cilicœa stylifera.
,, *ornata.*
,, *granulata.*
Cerceis nasuta.
Chitonopis spatulifrons.

The species previously known are :—

Zuzara emarginata, Haswell. (*Hab.*—Griffiths' Point, Western Port, Victoria).
Cymodoce tuberculosa, Stebbing. (*Hab.*—Swan River, Western Australia).
,, *aculeata*, Haswell. (*Hab.*—Port Jackson).
,, *convexa*, Miers. (*Hab.*—New Zealand).
Cilicœa hystrix, Haswell. (*Hab.*—Port Stephens).
,, *spinulosa*, Haswell. (*Hab.*—Port Jackson; Port Stephens).
Bregmocerella grayanus, Woodward. (*Hab.*—Port Jackson; Flinders Island; Bass Strait).

In working out the various species I have been much impressed with the paucity of information relating to this important group. Many structural features have been met with, regarding which little or nothing has been recorded, and numerous little points of generic or specific import have been a source of frequent delay.

Adequate definitions of some of the genera are still required, and the whole group is in great need of revision. As regards the species herein described, I have attempted to supply full descriptions of all the characters of importance, whether generic or specific, hoping such will prove useful in any future revision of the order.

There are many characters presented by the various appendages of the body which have been usually neglected in descriptions; some are of generic and others of specific import. Such, for instance, as the number and relative length of the joints of the flagellum; the presence or absence of denticles on the spines of the first maxillæ. The pleopods are rarely described, yet they afford some excellent and reliable characters: a glance at some of the descriptions and figures will suffice to show how necessary it is to examine these appendages. For example, the outer rami of the first and second pairs of pleopods in *Zuzara emarginata* are armed on their outer distal margin with a series of spines, thus furnishing a character which alone would be almost sufficient to identify the species. The uropods are generally well described, but one feature, namely, the opposed or folding condition of the branches is frequently neglected. In the genus *Cymodoce* the branches are stated to be opposed or imperfectly folding. I have met with two species, namely, *C. aculeata* and *C. convexa*, in which the branches are completely folding, and a third, *C. tuberculosa*, has the branches opposed.

Family SPHÆROMIDÆ.

SPHÆROMA, *Latreille.*

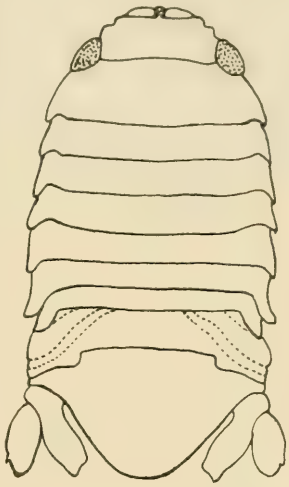
SPHÆROMA AUSTRALIS, sp. nov.

(Figs. 24*a-b.*)

Station 19.

Body smooth, convex, about twice as long as broad, slightly increasing in width posteriorly, cephalon not quite equal in

length to the first segment of the peraeon. Frontal margin with an indistinct median process, lateral margins somewhat thickened and bidentate. The basal joints of the antennæ are visible from above, their inner bases are separated by the inferior and superior frontal processes. First peraeon segment longer than either of the three subequal segments following, seventh segment much the shortest. Pleon equal in length to the six preceding segments; the penultimate segment is short, and the lines indicating coalescence are faintly marked. Ultimate segment strongly convex, the sides are converging, the extremity is broadly rounded and entire. The first epimeral process has the anterior border oblique and produced in front beyond the eye, the posterior border is transverse, and the extremity acute; the second and third are broadly rounded, the fourth is acute, the fifth is broad and obtusely rounded, the sixth is subacute, and the seventh obliquely truncated. Side plates of the pleon rather long, with the anterior margin rounded, and the posterior extremity acute. Eyes lateral, prominent, posteriorly deeply imbedded in the first peraeon segment. First joint of the anterior antennæ one-third longer than broad; the second is not so long as the width of the first; third joint slender, nearly as long as the first. Flagellum longer than the peduncle, consisting of ten joints, the second being the shortest. Peduncle of second antennæ shorter than the flagellum; the first two joints of the former are equal; the fourth is equal to the second and third combined. The flagellum has thirteen joints, the third of which is much the longest. Mandibles slender, the apical half narrow and suberect, cutting edge with four denticles; there is a large tridentate process below and a bunch of denticulated spines. Molar tubercle small, distinct, and situated close to the masticatory lobe. Lobes of the first maxillæ rather widely separated, the inner narrow and tipped with four pectinated setæ, the outer lobe is curved and diminishes in width towards the apex; the latter bears eight or nine strongly denticulated spines. The lobes of the second maxillæ are rather unequal in length and breadth. Palp of maxillipedes short and comparatively broad, with the setiferous lobes well developed;

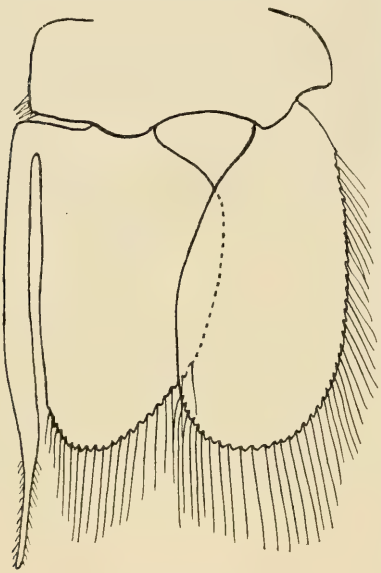


BODY VIEWED FROM ABOVE.
Fig. 24*a*.

the third and fourth joints are subequal, the last is short and about equal to the width of the first.

The first and second pairs of legs are subequal, the following pairs are rather stouter and longer. The fourth, fifth, and sixth joints are armed inferiorly with spines, which are more or less pectinated; the spines of the first and last pairs being the most distinct. The superior distal borders of the fourth joints are each furnished with similar spines; the same remark also applies to the fifth joint in all, except that of the first. The seventh joint is stout, curved, and very unequally didactyle.

Inner ramus of the first pair of pleopods elongate and subtriangular, outer ramus oblong. The inner ramus of the second pair is rather broader, and the outer narrower, than those of the first. The stylet is cylindrical, the apical fifth much attenuated, and bears numerous setæ along its distal margins. Outer rami of the following three pairs with sutural lines, the last exhibits five lobes, covered with rasp-like teeth; there are two near the apex, one in the middle of the border above the sutural line, and two immediately below it. Uropods subequal, the basal joint oblong and truncated at the extremity, the second joint is ovate, with a single small denticle on its outer distal margin.



SECOND PLEOPOD.

Fig. 24*b*.

Total length of body ... ... 10 mm
Breadth... ... ... 5·5 „

Four specimens obtained off Port Stephens. A large number of examples is in the collection from the same locality.

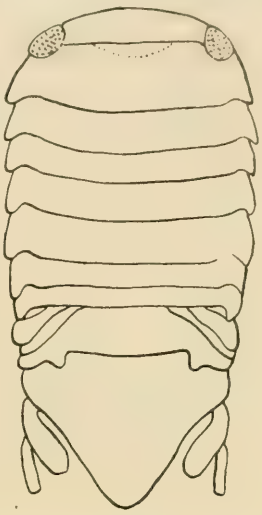
SPHÆROMA LATIFRONS, sp. nov.

(Figs. 25*a-b*.)

Station 33.

Body strongly convex, smooth, more than twice as long as broad, much wider in front than behind. Cephalon short—over one-

third shorter than the first segment of the peraeon; the latter is about one-third longer than the second or fourth; the third is equal to the fifth; the sixth and seventh are short, and subequal. Pleon a little longer than the six preceding segments, penultimate segment with the lateral sutural lines well defined. Ultimate segment large, strongly convex and subacute at the extremity. First epimeral process long, and produced in front of the eye, second to fourth acute, fifth truncated, sixth and seventh rounded; side plates of the pleon broadly rounded.



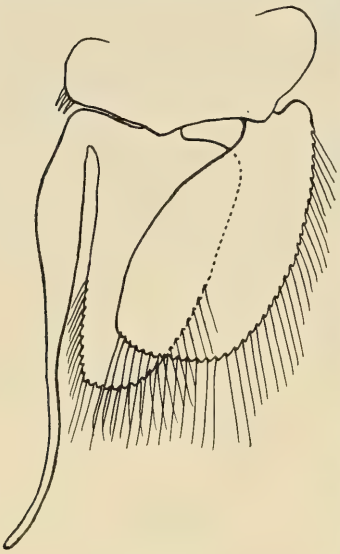
Body viewed from above.
Fig. 25*a*.

Eyes rather prominent and lateral.

First antennæ separated at their bases by a small process of the front, the peduncle has the basal pair of joints dilated, the third joint is slender and nearly twice as long as the second. Flagellum a little shorter than the peduncle, consisting of eighteen joints; the fifth joint is rather stouter and longer than those preceding or following. Second antennæ with the peduncle and flagellum equal in length; the first two joints of the former are short and equal, the third and fourth are each almost equal to the first and second combined; first and third joints of the flagellum subequal, second joint longer than the fifth, the remaining twelve joints are of equal length.

Mandibles angularly bent in their upper third, cutting edge unidentate obtuse with a bifid tooth below, subtended by a few curved denticulated spines, molar tubercle prominent, with the lower border acute; palp with three subequal joints. First maxillæ with the lobes of equal length, the inner narrow and tipped with four pectinated setæ, the outer broad, curved and surmounted with about ten denticulated spines. Inner branch of the second maxillæ rather longer and broader than either of the two outer lobes. Palp of maxillipedes short, the superior lobes well developed, third joint about equal in length to the width of the first. Legs increasing in length as the end of the body is approached. The fourth, fifth, and sixth joints of the first and last pairs are armed inferiorly with long spines, the same joints in the intermediate pairs have their inferior margins densely hairy. The seventh joint is comparatively elongate, and terminates in two unequal spines; the larger spine is situated at

the superior distally extremity, and the smaller one arises from the end of the lower border. The third joint of all the legs is angulated about the middle of the upper border, and the angle is ornamented with several long setæ. The superior distal margins of the two following joints are also furnished with tufts of long hairs. The inner ramus of the first pair of pleopods is narrowly triangular, the outer ramus is oblong-ovate ; rami of second pair broader than those of the first. The stylet in the male is rather broad in its basal fourth, from thence it tapers gradually to the very slender apical portion. Outer rami of the uropods linear about six times as long as broad ; when folded they extend beyond the processes of the first joints, and they arise from about the middle of their supporting joint.



SECOND PLEOPOD.
Fig. 25*b*.

Total length of body ... 10 mm.
Breadth ... ... 6 mm.

Three specimens obtained off Newcastle Bight.

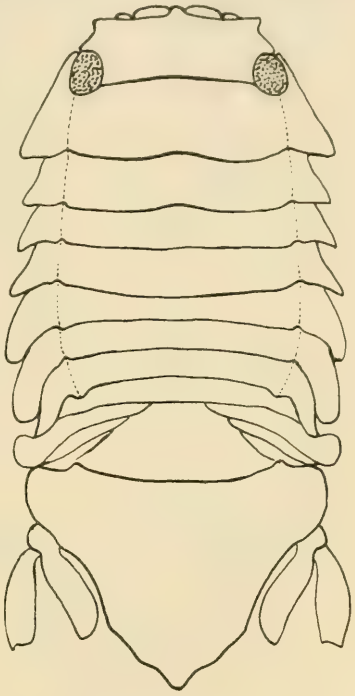
SPHÆROMA PLUMOSA, sp. nov.

(Figs. 26*a-b-c*.)

Stations 44, 48.

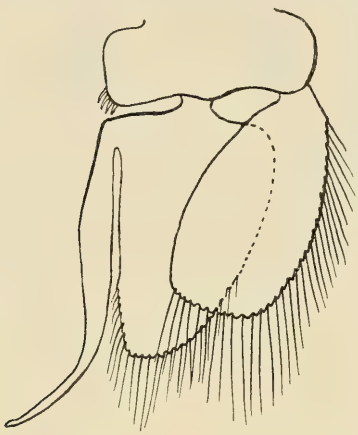
Body depressed, gradually increasing in height to the penultimate segment of the pleon ; fromt he later point it decreases rapidly to its termination. The whole of the surface and the margins of the body are closely covered with plumose hairs. Cephalon small, much narrower and a little shorter than the first peraeon segment. Frontal margin subtruncate, with a small median lobe; sides slightly excavated, each with a pair of denticles, one at the anterior external angle and the other immediately in front of the eye. First segment of the peraeon nearly equal in length to the two following; second to fourth subequal, each being about one-third longer than any of the three succeeding segments, which are also of about equal length. Pleon nearly equal to the peraeon ; the penultimate segment is convex, with the sutural

lines well defined. Terminal segment large; the sides are sinuous and the extremity rather narrow, rounded and entire. The first epimeral process is produced in front to the anterior margin of the eye; the posterior border is transverse and the posterior angle is subacute; the second, third, and fourth, when viewed from the side, are narrow, wide apart, and obtusely pointed; the fifth and sixth have their apices broadly rounded; the seventh is short, and acutely pointed. Side plates of the pleon curved and subspatulate. Eyes lateral, not prominent, with their posterior two-thirds imbedded in the anterior part of the first peraeon segment. Basal joints of the first antennæ moderately stout, visible from above, and projecting beyond the front; their inner bases are separated by the median cephalic process; the second joint is received into an excavation of the end of the first. Flagellum much shorter than the peduncle, consisting of eight joints; the second is a little shorter than the first or third, fourth and fifth equal, longer than those preceding or following. First and second joints of second antennæ equal, both of which are widened distally; third joint of nearly equal width throughout, and as long as the two preceding joints combined; fourth joint a little longer than the third, with the base narrower than the apex. Flagellum equal to the peduncle, with ten subequal joints. Mandibles strongly bent distally, the cutting edge tridentate, with a blade-like lobe at its inner base, tipped with three teeth, the median one being small; a few denticulated spines are also present. Molar tubercle prominent, and apically encircled with short, stout, simple spines. Palp consisting of three equal joints. Inner lobe of first maxillæ narrow, tipped with four pectinated setæ. Outer lobe gradually tapering from the basal third to the apex: the latter bears about fourteen denticulated spines. The



BODY VIEWED FROM ABOVE.
Fig. 26*a*.

second maxillæ are subequal in width, and attain to the same level. Palp of maxillipedes short, with the superior setiferous lobes well defined. The third joint is much shorter than the second or either of the two following. First pair of legs shorter and less robust than any of those following; the last pair are rather long and slender. The inferior borders of the fourth, fifth, and sixth joints are armed with numerous stout pectinated spines; there is a well-defined series on the borders, and a number scattered on the lower lateral surfaces. The third joint of all the legs except the last have the superior border prominently angulated in the middle, and tipped with a stoutish spine. Fourth and fifth joints of the second to the fifth legs nearly as broad as long, with the superior borders prominent, and ornamented with one or two spines at the distal extremity; seventh joint terminating distally with two very unequal spines, the superior one large, strong, and curved, the inferior one short and stout.



Second Pleopod.
Fig. 26*b*.

Fifth Pleopod.
Fig. 26*c*.

Inner ramus of the first pair of pleopods rather narrow, tapering from the base to an obtuse apex; outer ramus ovate. Inner ramus of the second pair about twice as long as broad; the stylet is subfusiform in its lower two-thirds, the apical fourth is long, curved and slender. Outer rami of the three succeeding pairs, with a sutural line, both rami of these are ciliated at their distal extremity. The outer ramus of the fifth pair bears five bead-like lobes covered with rasp-like teeth; there is a pair at the distal end, one on the sutural line, and two situated at the distal fourth of the inner border. Uropods oblong, equal and folding, the outer truncated at the extremity.

Total length of body, 9 mm.; breadth, 4.5 mm.

This species is allied to *Sphæroma aspera*, Haswell.

One specimen obtained off Coogee and two off Wollongong.

ZUZARA, *Leach.*

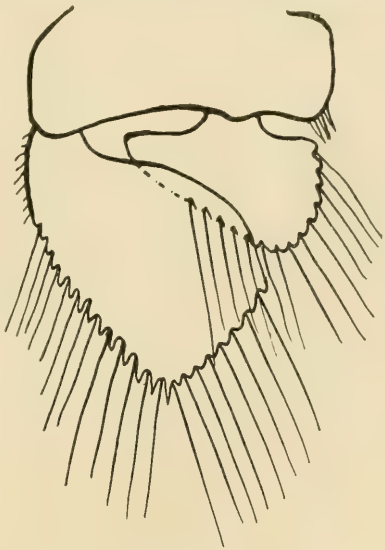
ZUZARA EMARGINATA, *Haswell.*

Zuzara emarginata, Haswell, Proc. Linn. Soc. N.S.W., vi., 1882, p. 188, pl. iii., fig. 6.

(Fig. 27.)

Station 57.

Two young females of this species were obtained off Wata Mooli. The examples differ considerably from the adults, and could scarcely have been identified without the aid of Haswell's types. The pleopods furnish excellent specific characters, which are probably sufficient to recognise this species by at any age. The inner ramus of the first pair is twice as broad as long, the outer rami of both the first and second pairs are armed on the outer distal border with ten or twelve spines, together with the usual plumose setæ. The outer ramus of the third pair has a well-marked sutural line. Both rami of the succeeding pairs possess branchial pleats, and the outer ramus of the last is provided with three small teeth-bearing lobes, one at the summit, another about the middle of the apical part of the lamina, and the third is on the inner border below the sutural line. The stylets of the male in Haswell's type are broken off, they arise from the middle of the inner margin of the ramus. The mandibles are moderate in size, the cutting edge is thin and dentate, the inferior tooth is tridentate and attended by an inferior bunch of curved denticulate spines. Molar tubercle well defined, and encircled with spinules. Palp consisting of three subequal joints. First maxillæ tipped with denticulated spines. Second maxillæ short, broad, and subequal in size. Maxillipedes small, the superior setiferous lobes are well developed, the third joint is much shorter than the second, fourth, or fifth. The flagellum of the first antennæ is ten-jointed, the



First Pleopod.
Fig. 27.

first of which is much the longest. The flagellum of the second antennæ consists of fourteen articulations, the third is rather shorter than those preceding or following, the sixth, seventh, and eighth are equal in length to that of the first.

Zuzara integra, Haswell,* is identical with *Cycloidura venosa*, Stebbing.†

Obtained off Wata Mooli.

CYMODOCE, *Leach.*

CYMODOCE TUBERCULOSA, *Stebbing.*

Cymodoce tuberculosa, Stebbing, Ann. Mag. Nat. Hist., (4), xii., 1873, p. 95, pl. iii., fig. 1.

(Fig. 28.)

Stations 31, 44.

Anteriorly, the body of the adult male is somewhat narrowed, the frontal margin being a little more than half the posterior width of the first peraeon segment; from this point the body gradually increases in width to the sixth segment. The cephalon is about one-third longer than the first segment of the peraeon, the latter is equal to any two of those succeeding. The whole upper surface of the body, including the uropods, is minutely granulose; the second and following segments have a transverse series of subconical tubercles seated on the anterior margin; the third to sixth with similar but smaller series, which are somewhat unequal in size and in distance apart, and nearer to the hinder margin than to the middle. The pleon exhibits two or three lateral sutures indicating the coalesced segments, each of which is marked by a more or less distinct row of granules.

The terminal segment has a slight longitudinal median depression, which is also indicated on the preceding segment, laterally, the sides are convex, and ornamented with two clusters of small tubercles, those situated distally are seated on a slight oblique ridge, posterior margin with three blunt processes, the median one is somewhat elevated superiorly and shorter than lateral pair. First antennæ with the basal joint stout, about three times as long as broad, without the marginal denticles; the latter are four or five in number, they project along the anterior border and gradually increase in size outwardly. Second joint about equal in length and breadth to half the width of the first; third joint slender, five times as long as broad.

* Haswell—Proc. Linn. Soc. N.S.W., vi., 1882, p. 186, pl. iii., fig. 6.

† Stebbing—Jour. Linn. Soc., xii., 1874, p. 146, pl. 6.

The flagellum consists of fourteen articulations, each of which carries three or four setæ on the upper distal margin.

The second antennæ have the first joint stout, and about twice as long as broad; second and third narrower, but equal in length to the first; fourth joint nearly equal in length to the two preceding combined. Flagellum with nineteen articulations; the third joint is much shorter than those preceding or following, excepting the last two at the tip.

Mandibles short, stout, the upper third strongly bent inward, cutting margin with four or five denticles, which are subtended below by a series of flat, broad based spines, they taper gradually to acute points. Molar tubercle close to the denticles well defined, especially below. Palp about equal in length to the mandible, with three subequal joints.

First maxillæ with inner lobe rather stout and tipped with four long pectinated spines, the outer lobe carries twelve or more rather slender simple spines, which taper rapidly to acute points. Second maxillæ with the inner lobe twice as long as broad; the upper inner margin and the distal extremity are armed with pectinate spines; the outer lobes are tipped with long unbranched setæ.

Upper portion of the second joint of the maxillipedes shorter and broader than the lower, the outer margin is strongly convex, the inner straight with a short filament about the middle; the apical margin and the external distal surface carry numerous short pectinate spines; the joints of the palp are peculiar in shape, as will be seen in the accompanying figure.

Right Maxillipede.
Fig. 28.

The first three pairs of pleopods have the peduncle armed on the interno-distal angle with three or four spines. The inner ramus of the first is conical in outline and shorter than the outer; the latter is oblong with almost straight sides, pointed proximally and slightly convex distally. Outer ramus of second pair oval; inner similar in shape to that of the first, but longer and broader. The stylet is a little longer than the ramus; it is comparatively broad and of equal

width to within a short distance of the summit; the outer margin is straight throughout; the inner distal border is oblique and slopes to the subacute apex; both margins are minutely ciliate. Apex of the outer ramus of the fifth pair tumid; there is a pyriform lobe in the middle of the inferior surface just above the suture; the latter is thickened on the inner angle, and there is a small tubercle at some distance below; the inner aspect of the distal margin and the tubercles are clothed with rasp-like denticles.

Outer ramus of uropods very small; when closed its internal border is opposed to that of the inner branch.

Length of adult male	11 mm.
Width of frontal margin	3 ,,
Greatest breadth of first peraeon segment ...	5 ,,
,, ,, ,, body at the sixth segment	6 ,,

Eight examples were obtained off Cape Hawke, and ten off Coogee Bay, in 25 to 50 fathoms.

CYMODOCE CONVEXA, *Miers.*

Cymodoce convexa, Miers, Cat. Crustacea, Col. Mus. & Geol. Surv. N. Zealand, 1876, p. 114, pl. iii., fig. 6.

(Fig. 29.)

Stations 21, 50, 55.

This species is represented by about seventy specimens. The tubercles on the terminal segment vary greatly; in some examples they are scarcely visible, in others often prominent, ridge-like and frequently three instead of two are present on each side of the median line.

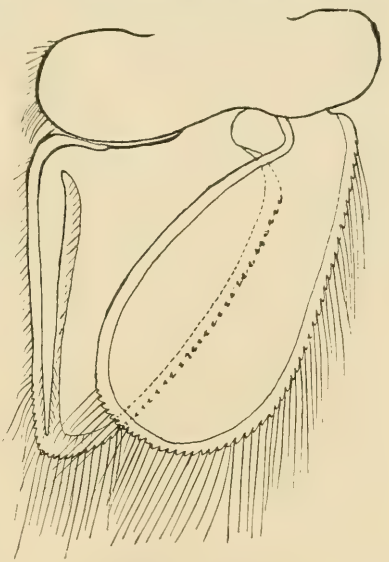
Mandibles moderate, about three times as long as broad; apical denticle with a slight rounded lobe inferiorly; secondary tooth subtrilobate at the summit; the stouter accompanying setæ have several seriate spinules on the upper surface. Molar tubercle fairly well defined; a small broadly conical process is present between it and the dental setæ. Palp rather short, with compressed joints, of which the first is broader but of equal length to the second.

The first maxillæ have the inner lobe stout and tipped with four strong pectinated spines; the outer lobe bears about twelve simple curved spines; another larger set is plainly visible within the lobe about the middle, ready for use at the next moult.

The maxillipedes have the upper portion of second joint a little longer and broader than the lower; the former has the usual

curved filament at the distal third of the inner margin, and the apex bears a series of short pectinate spines ; a few are subapical and arise from a point opposite the marginal filament. The second, third, and fourth joints of the palp are provided with setæ tipped lobes, the fifth joint is subcylindrical and terminates in a tuft of setæ.

The first two pairs of pleopods have a few spines on the interno-distal angle of the peduncle ; the inner ramus of the first is sub-triangular, with inner margin straight ; outer ramus obovate and rather narrow at the base ; outer ramus of second pair similar to that of the first, the inner is longer and slightly broader than the first. With a view of describing the stylets I examined nearly the whole of the specimens without finding a single fully developed male. I considered this rather strange and determined to make further examination. After dissecting out the inner rami from many specimens I found several immature males, some with only the slightest trace of stylets, and one with the stylets almost fully formed, but these could not be functional until after casting the integument, inasmuch as they are completely inclosed in the lamina of the inner rami (see fig. 29). Outer ramus of fifth pair of pleopods with two equal tubercles at the apex, and one on the inner distal extremity of the suture with a small accessory tubercle as its base ; the inner distal margin, as well as the tubercles, are closely covered with rasp-like denticles. Outer ramus of uropods nearly hidden when closed.



Second Pleopod.
Fig. 29.

Length of largest male	15 mm.
Breadth „ „	6 „
Length of female	12 „
Breadth „	5 „

The specimens were obtained in Newcastle Bight, off Shoalhaven River, in Jervis Bay, and off Crookhaven River, in 11 to 27 fathoms.

CYMODOCE ACULEATA, *Haswell.*

Cymodoce aculeata, Haswell, Proc. Linn. Soc. N.S.W., 1880, v., p. 474, pl. xvi., fig. 6; *Id.*, Aust. Mus. Cat. v., Crustacea, 1882, p. 291.

Stations 33, 50.

This species is represented by twelve examples ; in the original diagnosis the fixed ramus of the uropod is stated to be emarginate ; the emargination is scarcely discernible in the types ; the distal extremity is obliquely truncated, and apparent emargination is due to a slight median depression on the superior surface. Fourth, fifth and sixth joints of the first pair of legs armed with spines ; the same joints in the succeeding pairs are densely covered with numerous short hairs and a few stiff setæ. The mandibles are moderately robust, the apical denticle is blunt, the lateral one is subtrilobate at the apex, and the accompanying spines are mostly simple ; a few of the larger have two or three irregularly disposed spinules. Palp three-jointed, with the basal joint the longest. Inner process of first maxillæ slender, armed at the tip with four spines, each of which bears numerous long spinules. Outer process with about twelve or fourteen stout, smooth, curved spines. Lobes of the second maxillæ armed with pectinate spines ; the inner lobe is rather broad, and the fringe of spines extends some distance along the oblique inner border. Upper and lower portions of the second joint of the maxillipedes subequal ; there is a short curved filament at about the distal third on the inner border, and the truncated apex bears about fourteen or more short, stout, strongly-pectinated spines. Second, third and fourth joints with well-developed superior lobes ; fifth joint cylindrical, tipped as well as the lobes with long, simple setæ ; there are also a few long hairs at the inferior distal extremities of the joints. Peduncles of the first three pairs of pleopods with three to five spines situated at the interno-distal angle. Inner ramus of the first pair nearly triangular. Outer ramus much longer than the inner, more than twice as long as broad, and twice as wide distally as proximally, with the outer margin straight. Rami of the second pair equal in length, and proportionately broader than those of the first; the outer ramus is obovate, and the inner cone-shaped in outline, with a slender stylet about one-third longer than the ramus ; in its basal two-thirds the stylet is fusiform, and the terminal third is cylindrical, and bears numerous hairs, which become more evident as the acute apex is approached. Outer rami of the third, fourth, and fifth pairs with a subapical suture ; the fifth has several distal tubercles, which, as well as the margin, exhibit a closely-placed series of rasp-like teeth. There is a rounded tubercle at the summit, a compressed one on

the middle of the upper inferior surface and two small and bead-like on the inner border—one at the suture, and the other at a short distance below it. Outer ramus of uropods folding under the inner, and almost concealed when closed.

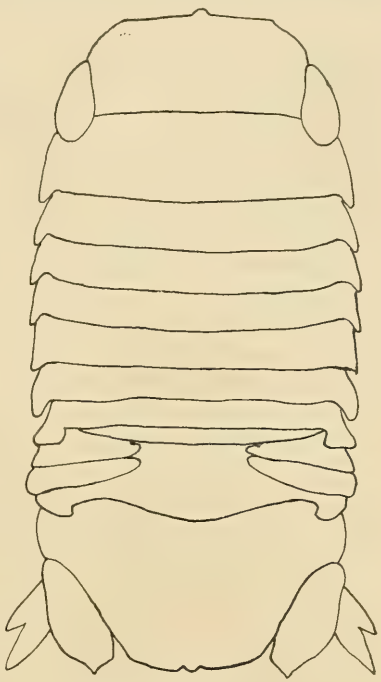
Obtained at Newcastle Bight, and off Shoalhaven in 15 to 27 fathoms.

CYMODOCE INORNATA, sp. nov.

(Fig. 30.)

Station 48.

Body minutely hairy, and very finely granulose. Frontal margin of the cephalon rather broad, with a small median process. First segment of the peraeon as long as the cephalon, second to seventh short, gradually decreasing in length. Epimera of the first segment acutely produced in front, angular behind; on the second, third, and fourth they are narrow, acute, with their apices directed downwards, and inclined towards the posterior end of the body; the fifth is obtuse; the sixth and seventh are subfalcate and acute. The pleon exhibits four segments—the first is short and continued from side to side, the second and third are only indicated laterally, the fourth is the longest, its posterior border is convex and slightly thickened. The epimeral processes of the pleon are longer than those of the peraeon; the first has a rounded lobe on the anterior border. The sutures indicating the union of the epimera with the body are well defined on the peraeon, but absent on the pleon. Terminal segment convex, somewhat flat at the vertex, and there is a slight semicircular depression which extends from one uropod to the other; posterior



Body viewed from above.
Fig. 30.

margin subtruncate, with three small denticles; the median is rounded, and as long as the lateral ones.

Eyes longer than broad; the pigmented area is cuneate in outline, with the narrow end directed backwards. Basal joint of first antennæ stout, twice as long as broad; second joint short—its length is about equal to two-thirds the width of the first; third joint slender, half the length of the first. Flagellum consisting of twenty-three articulations; the first joint is equal in length to the three following, the rest are subequal; each has a few setæ on the inferior distal margin. First joint of the second antennæ a little longer than broad, not wider than those succeeding; second joint one-third longer than the first, and about the same shorter than the third; fourth joint equal in length to the two preceding combined. Flagellum with seventeen joints, the first being equal to the two following, third, fourth, and fifth equal, the rest gradually increase in length to near the apex.

Mandibles stout, nearly straight, cutting edge entire, with an accessory trilobate denticle and a series of spines, the larger of which bear one or two spinules. Molar tubercle ill-defined, and rather remote from the cutting edge. Palp one-third shorter than the mandible, the first joint longer than the second or third, which are equal. Inner lobe of first maxillæ slender, tipped with four pectinate spines; outer lobe with twelve simple curved spines on the distal extremity. The lobes of the second maxillæ have their apices armed with pectinate setæ or spines; those on the outer lobes have the spinules forming the pectination very minute.

Maxillipedes with distal and proximal portions of the second joint equal in size; the former bears on the distal margin, and also on the external surface, a dense series of stout pectinated setæ, and a short curved filament on the inner border. Second joint of palp very broad distally, equal in length to the two succeeding; fifth joint short, about equal to the fourth, and also to the superior lobes of third and fourth. The first pair of legs is imperfect, the succeeding pairs have the fourth, fifth, and sixth joints covered inferiorly with numerous short, closely-placed yellow hairs. Peduncles of the first three pairs of pleopods with three or four spines on the interno-distal angle; the inner ramus of the first is triangular, the outer is narrowly obovate. Inner ramus of the fifth pair a little tumid at the apex, with an elongate papilliform lobe on the middle of the inferior distal surface, and a bead-like tubercle on the inner margin below the suture; each process and the inner aspect of the distal border are clothed with rather large rasp-like denticles. Uropods a little unequal, inner branch ovate-oblong, widest at the distal third, the outer distal angle pointed, the apical margin obliquely truncated on its inner

aspect. Outer ramus bidentate, as long or a little longer than the inner when closed; the outer denticle is short, and separated from the inner by a V-shaped space. The outer ramus can be folded under the inner.

Length of adult female	...	...	...	16 mm.
Breadth „ „	...	...	...	8 mm.

A single example was obtained off Wollongong in 55-56 fathoms.

CILICŒA, *Leach.*

CILICŒA HYSTRIX, *Haswell.*

Cilicœa hystrix, Haswell, Proc. Linn. Soc. N.S.W., vi., 1881, p. 183, pl. iii., fig. 1; *Id.*, Aust. Mus. Cat., v., Crust., 1882, p. 296.

Station 13.

This species was described from male examples, of which there are two in the collection labelled as types. A note following the diagnosis of *C. spinulosa*, Haswell, casts a doubt on the identity of the form depicted in figure 2 on plate iii.* The "Thetis" material affords two specimens, both of which are undoubtedly females of *C. hystrix*. It is highly probable that Haswell's figure (Pl. iii., fig. 2) represents the female of *C. spinulosa*.

The sexual differences in *C. hystrix* are very slight. The spines in the female are fewer, shorter, and the forked process of the first pleon segment is wanting.

Two specimens obtained off Cape Three Points in 41-50 fathoms.

CILICŒA SPINULOSA, *Haswell.*

Cilicœa spinulosa, Haswell, Proc. Linn. Soc. N.S.W., vi., 1882, p. 184, pl. iii., fig. 3; *Id.*, Aust. Mus. Cat., v., Crustacea, 1882, p. 297.

(Fig. 31.)

Station 25.

A single male example was obtained off Cape Three Points. It differs somewhat from the types, and also from the other examples, in being much less spinose. The flagellum of the first

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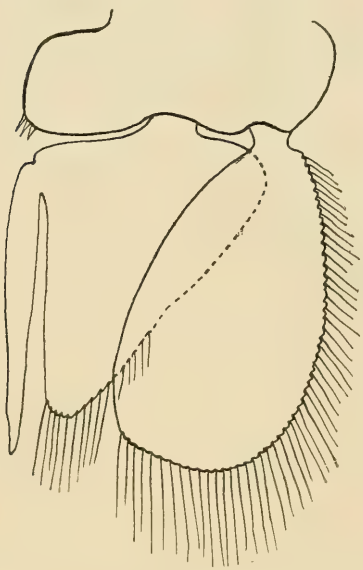
Haswell—Proc. Linn. Soc. N.S.W., vi., 1881, pl. iii., fig. 2.

antennæ is shorter than the peduncle; it consists of sixteen articulations, the first joint is equal to the two following combined. The second antennæ have the basal joints equal to, but stouter than the second; third joint one-third longer; fourth is longer than the two preceding. Flagellum slightly longer than the peduncle, with sixteen joints, the second is shorter than the first, the third is much the longest in the basal series. Mandibles nearly erect, with the outer border straight, cutting edge with a blunt denticle, and subtended below by a bunch of uniserially branched spines and a well-developed molar tubercle. Palp small, three-jointed, the last joint shorter than those preceding. First maxillæ with the masticatory lobe stout, and surmounted with seven or eight simple spines; inner lobe rather small, tipped with four stout branched setæ. Second maxillæ equal in height, the inner lobe rather broad. Maxillipedes with the second joint stout, palp short with prominent setiferous lobes, the third joint shorter than second or fourth. Legs subequal, the last pair somewhat slender; the fourth joint of the first pair bears six spines on the inferior border; the same joints in the succeeding legs have four spines, and the same number occurs on the fifth and sixth joints; they are very unequally didactyle at the extremity. First pair of pleopods with inner ramus triangulate, much smaller than the ovate-oblong outer branch; the rami of the second are similar in outline to those of the first; the cylindrical stylet is a little longer than its support, and suddenly norrowed near the apex.



SECOND PLEOPOD.
Fig. 31.

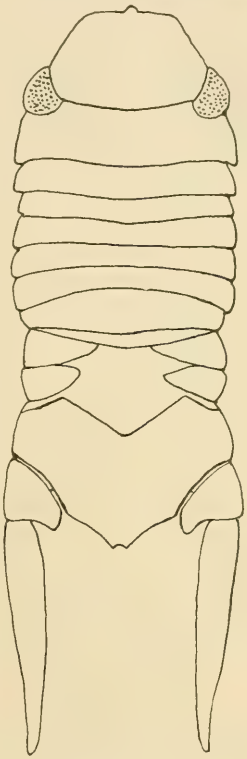
This species is fairly common on the coast; I have found it occupying oscula-like openings in sponges. In one instance, in a sponge from Maroubra Bay (*Chalina finitima*), the cavities occupied by the Isopod are lined with a very compact layer of fine fibres, which are much more closely arranged and denser than any other part of the sponge.

CILICŒA STYLIFERA, sp. nov.

(Figs. 32*a-b.*)

Stations 13, 37, 57.

Adult male.—Body granular, convex, more than twice as broad as long, narrowest at the juncture of the peraeon with the pleon. Cephalon about one-third wider than long. Frontal margin truncated, with a prominent median lobe and the sides oblique. First segment of the peraeon longer than the two following segments combined. Pleon nearly equal to the peraeon in length. The coalesced segments are well defined Terminal segment convex; the posterior third is almost free from granules, and the extremity has an inferior median semicircular notch bounded by a pair of minute denticles. Epimeral process of the first segment of the peraeon with a thickened oblique margin and a truncated inferior border, the second is cuspidate, the third minute, fourth elongate, fifth to seventh broadly pointed. Epimera of the pleon very large, the margins thickened and semicircular in outline.



Body viewed from above.
Fig. 32*a*.

Eyes lateral and rather prominent. Basal joints of first antennæ dilated, separated at their bases by the frontal lobe. First joint more than three times longer than the second, with the external surface granulated. Flagellum twice as long as the peduncle; the first joint equal in length to the three following; the remaining nine are about of equal length. Second antennæ slender; the first and second joints subequal, third nearly equal to the two preceding, fourth joint much longer than the third. Flagellum equal in length to the peduncle, consisting of ten joints; the first pair is equal and the third the shortest.

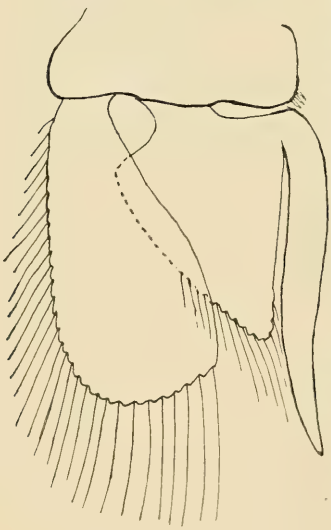
Mandibles stout, the width at the summit being equal to half the length, cutting edge broad, simple, subtended below with a few spines and several spinules. Molar tubercle obtusely conical, apically furnished with branched and simple spinules. Palp three-jointed, the first short and stout, the two following are equal.

Anterior maxillæ with masticatory lobe, elongated, tipped with simple curved spines; inner lobe with four branched setæ, the internal one being much the longest.

Posterior maxillæ with the inner lobe rather broader than either of the two outer.

Maxillipedes slender.

First pair of legs shorter and stouter than those succeeding. The fourth, fifth and sixth joints are each armed on the inferior border with three stout spines, which are very unequally bi- or trispinose at their apices. Seventh joint terminated in two unequal spines, separated by a long stiff setæ. Peduncles of pleopods armed on their inner distal angles with several spines. Outer ramus of the second pair obovate; inner ramus triangular; the stylet is fusiform in shape, one-third longer than the ramus, and quite glabrous. The outer ramus of the last pair terminates in a broad rounded lobe covered with rasp-like teeth; another similar lobe is present on the inner aspect below the sutural line. Basal joint of the uropods broader than long, obtusely pointed on the inner side; last joint styliform, about equal to the peraeon in length; colour white, and in strong contrast to the rest of the body. The female does not differ materially from the male.



SECOND PLEOPOD.
Fig. 32*b*.

Length of body ...	...	...	5 mm.; total 7 mm.
Breadth ,, ...	...	...	3 mm.

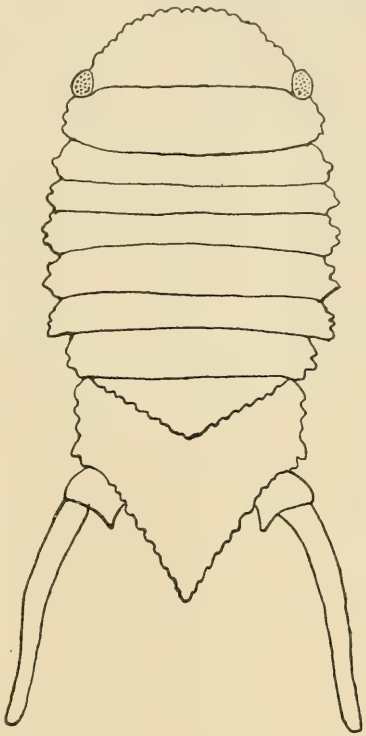
Obtained off Cape Three Points, Botany Bay, and Wata Mooli.

CILICŒA ORNATA, sp. nov.

(Figs. 33*a-b*.)

Stations 13, 28, 37, 38.

Adult male. Body strongly convex, about twice as long as broad, closely covered with very prominent subspiniform granules, the larger of which are 0·1 mm. in height and 0·05 mm. in diameter. Cephalon with the frontal border rounded, about three times as wide as long, and equal in length to the first segment of the peraeon ; the latter is equal to the two segments following ; the fourth to the seventh segments are subequal. The pleon is about equal to the six preceding segments combined. The median process on the penultimate segment is small, and but little prominent. The sutural lines indicating the coalesced segments are obscured by the peculiar character of the granulation. The terminal segment is large, convex, and acutely produced at the extremity, with a small semicircular notch, which is not visible from above ; the sides are converging. The first epimeral process of the peræon is twice as long as any of those following, with a slight lobe on the posterior third of the broad inferior border. Second to fourth equal, subacute, and directed backwards ; fifth to seventh broadly rounded, and decreasing in size posteriorly.



Body viewed from above.
Fig. 33*a*.

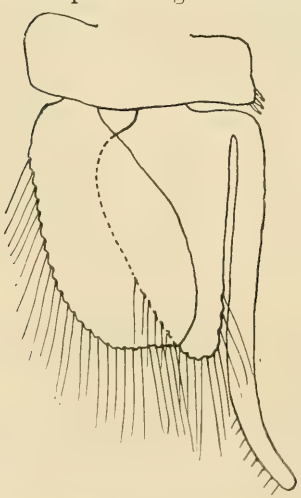
The second to the seventh segments of the peraeon are each ornamented with a single transverse row of granules, and the bases of the epimeral processes are marked by two or three blunt, conical granules ; the rest of the upper surface of the body is studded with scattered granules and short, stiff setæ.

Eyes subreniform, prominent, dark brownish black in colour.

The first antennæ have their inner bases separated by an ill-defined process of the front The basal joint is stout, with anterior surface coarsely granulose; second joint smooth, its length being equal to the greater diameter of the first; third joint slender, more than one-fourth longer than the second. Flagellum with ten articulations; the second and third are equal, and shorter than any of the others; the first, fourth, and fifth joints are equal.

Second antennæ with the peduncle about one-fifth shorter than the flagellum; the last joint of the former is equal to the two preceding combined. The flagellum consists of eleven joints, the first and second subequal, and longer than any following; the third, fourth, and fifth are the shorter; the sixth and seventh are a little shorter than the second. Mandibles moderate, with the cutting edge unidentate; accompanied below by two or three stout spines, and some slender ones with spinulose borders. Molar tubercle well defined. Palp three-joint, the first stout, and much longer than those succeeding. The inner lobe of the first maxillæ is tipped with four curved spines; the inner pair is almost smooth and swollen at the apices, the outer pair is pectinated. The outer lobe bears eight or ten simple curved spines at its summit, and its inner border is fringed with distant hairs. Maxillipedes rather small; the third joint of the palp is shorter than the fourth or fifth; the superior lobes are elongate and setiferous at their apices.

First pair of legs stouter than any of the following pairs; the fourth, fifth, and sixth joints are each armed inferiorly with two spines; they are situated near the distal extremity, and their apices are furnished with one or two accessory spinules.



Second Pleopod.
Fig. 33*b*.

Inner ramus of first pair of pleopods subtriangular, and about one-third longer than wide. Outer ramus ovate-oblong. The inner ramus of the second pair carries a subcylindrical stylet on its inner base; it is curved inwards distally, and bears a series of very short setæ on the outer aspect of the terminal fourth. The outer ramus of the last pleopods has two bead-like teeth bearing lobes at the distal extremity, and another on the inner margin below the sutural line.

Inner branch of the uropods small, with a slight inwardly-directed denticle. Outer branch smooth, cylindrical, tapering distally, slightly curved, and equal to or exceeding the pleon in length.

The granulation in the female is much less prominent than in the male; the uropods are wanting in the only female specimen available.

Length of body	...	...	...	...	8 mm.
Breadth „	...	...	...	...	3·5 mm.

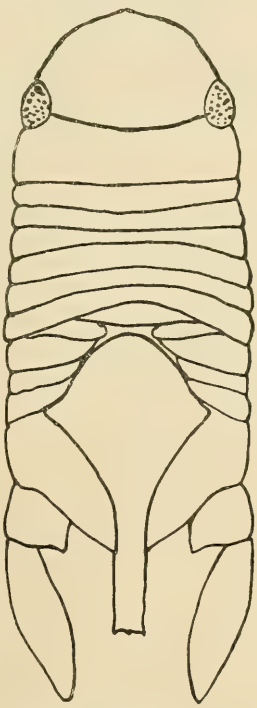
Obtained off Cape Three Points, Manning River, and Botany Bay.

CILICŒA GRANULATA, sp. nov.

(Figs. 34*a-b.*)

Stations 37, 38, 49, 55, 57.

Adult male—Body strongly convex, about twice as long as broad, upper surface closely covered with moderately prominent granules; those occurring on the pleon and uropods are subspiniform, and have numerous short, stiff setæ interspersed between them. There are faint indications of four longitudinal rows of larger granules, of which two are submedian, and two laterally situated; these larger granules are more pronounced in the male than in the female. Cephalon one-third broader than long, front unevenly rounded, with a distinct median lobe. First segment of the peraeon one-third shorter than the cephalon, and about equal in length to the three following segments; the remaining three segments are subequal in length, the last being much longer at the sides than in the middle. Total length of the pleon slightly longer than the peraeon and cephalon combined. The coalesced segments are well defined, the median process is large, convex at the base, and dorso-ventrally compressed at the extremity, with three small terminal subspiniform granules; it extends beyond the end of the last segment, but is much shorter than the extended outer branches of the uropods. Terminal segment of pleon with a well-defined semicircular notch bounded at the sides by a pair of small denticles, and above by a thickened border, anterior to which is a well-marked trans-



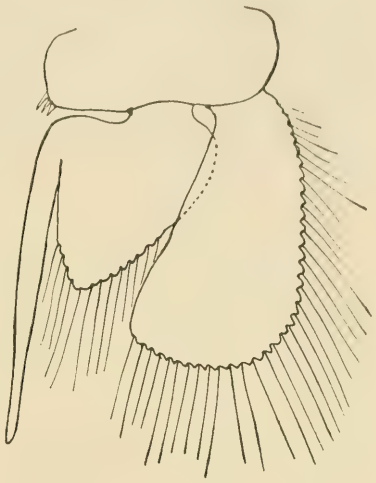
Body viewed from above.

Fig. 34*a*.

verse groove extending to the insertion of the uropods. First epimeral process of the peraeon large, with the anterior border obliquely curved and reflexed; the posterior border is acute, and directed backwards; the second to fourth are about twice as deep as long, and obtusely pointed; the fifth, sixth and seventh are broadly rounded. Side plates of the pleon large, with the anterior border rounded. Eyes oblong, the pigmented area is surrounded by a slightly raised granular border. First antennæ with the basal joint stout, its anterior surface strongly granulose, and sparsely setose; second joint as long as the width of the first, a few granules are presented on its anterior surface; third joint slender, one-fourth longer than the second. The flagellum is equal to the peduncle in length, and consists of eleven articulations, the first joint is the longest, the fourth, fifth and sixth are equal, and nearly one-third longer than the second, third, eighth, or ninth. The second antennæ have the first and second joints equal; the third is a little longer than the first, the fourth is as long as the two preceding combined. Flagellum longer than the peduncle, consisting of thirteen joints, the second is shorter than first or third, the fourth is shorter than any preceding or following. All the joints have a superior transverse row of setæ on the distal margin; the second and third joints have, in addition, a second row of setæ situated in the middle of the external surface. Mandibles stout, angularly bent near the summit; cutting edge unidentate, obtusely rounded, with one stout, and four or five slender spines at its base; molar tubercle well defined but not prominent. Palp three-jointed, the first stouter and longer than the second or third. Outer branch of the first maxillæ rather broad, tipped with about ten simple curved spines, the inner border bears a series of long hairs, which are confined to the middle third; inner branch short, with four curved branched setæ at the summit. Palp of the maxillipedes with the superior lobes elongated and clothed at their apices with long setæ, the third and fourth joints are about one-third shorter than the fifth. First pair of legs rather slender; the fourth joint is armed inferiorly with four stoutish spines, two near the middle and two at the distal extremity; the fifth joint has three spines, and the sixth four, the distal one being stouter than those preceding; the seventh joint has a pair of unequal spinules arising from the base of the large terminal spine. The inner ramus of the first pleopods is triangular, with the sides equal; the outer ramus is oblong, and becomes wider as the subtruncated summit is approached. The rami of the second pair are similar to the first in shape, the inner ramus bears a subfusiform stylet at its base, the distal half projects beyond the ramus, and is suddenly narrowed and quite glabrous. Outer ramus of the fifth pair with a dome-shaped apex and a papilliform process near the middle of the lamina above the sutural line;

below the latter, on the inner margin, is another lobe; the whole border above the suture and the raised processes are furnished with rasp-like denticles. Inner joint of the uropods one-fourth longer than broad, with a small backwardly directed denticle on the inner angle. Outer joint seven times longer than broad, narrowly lanceolate in outline, the inner border is compressed and acute.

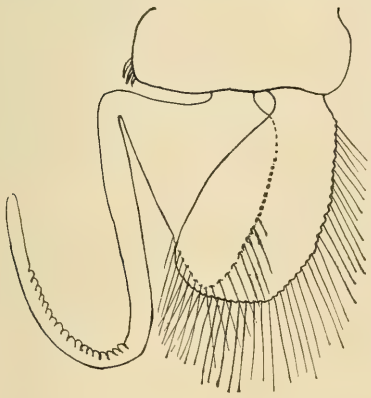
The female differs from the male in having a submedian pair of tubercles transversely disposed behind the middle of the terminal segment and in wanting the long process on the penultimate segment, its evidence in the female being a short conical tubercle.



Second Pleopod.
Fig. 34*b*.

Total length of male (uropods included) ... 13 mm.
Breadth ... ... 5 ,,

This species has a superficial resemblance to *Cilicœa crassicaudata*, Haswell, in the contour of the body, and also in size. The type, however—a solitary male example—proves to be very distinct from the species described above. In *Cilicœa crassicaudata* the granulation is very fine and scarcely visible to the unaided eye, the cephalon shorter than in *C. granulata*, and the segments of the peraeon longer. The dorsal process is much wider at its origin and thicker at its rounded extremity, and the terminal segment has a well defined denticle in the centre of the notch. The inner branch of the uropods has an inwardly directed, subtruncated denticle, and the outer ramus is of even width throughout; the apex is a little more obtuse than indicated in the figure.



Second Pleopod.
Fig. 35.

The differences in the second pleopod are very marked; in *C. crassicaudata* (fig. 35) they are much larger, the stylet being very remarkable for its length, curvature, and corrugated muscular band; the latter is situated on the inner side of its distal half, and in its present contracted condition prevents the stylet from being straightened out.

Obtained off Botany, Jibbon, Port Kembla, Crookhaven River, and Wata Mooli.

BREGMOCERELLA, *Haswell.*

BREGMOCERELLA GRAYANUS, *Woodward.*

New Isopod, Woodward, Rep. Brit. Assoc. for 1869 (1870), trans. sect., p. 118 (title only).

Ceratocephalus grayanus, Woodward, Encyc. Brit., ninth edit., vi., p. 659, fig. 72.

Ceratocephalus grayanus, Beddard, Chall. Report, Zool., xvii., 1886, p. 148.

Bregmocerella tricornis, Haswell, Proc. Linn. Soc. N.S.W., ix., 1885, p. 1004, pl. liii., fig. 1.

Stations 33, 35.

In the year 1869 Mr. H. Woodward read a paper "On a new Isopod from Flinders Island." The same author briefly describes and figures the species in the Encyclopædia Britannica under the name of *Ceratocephalus grayanus*, a MS. name given by Adam White.

In 1885 Mr. (now Prof.) W. A. Haswell redescribed it as *Bregmocerella tricornis*. Mr. Woodward, in publishing A. White's MS. name, apparently overlooked the genus *Ceratocephala*, which was erected by Warder in 1838 for the reception of a Trilobite.* Under the circumstances the equally expressive *Bregmocerella* must replace *Ceratocephalus* as the generic name.

There are a few important characters which have not hitherto been fully described, viz., the mouth parts and the pleopoda. Mandibles stoutish, about twice as long as broad; cutting edge blunt, unidentate, subtended below by a small compressed lobe and a corneous column, upon which a cluster of short simple spines are seated; the spines are about one-third the length of the column. Molar tubercle ill-defined, its transverse diameter is less than the length of the apical denticle. Palp rather short,

* J. A. Warder—Amer. Journ. Science, xxiv., 1838, p. 377.

consisting of three subequal joints; the second has the distal border armed with strong pectinated setæ; the margin of the third joint is fringed with simple setæ, and two or three long pectinated ones at the summit. First maxillæ with the inner lobe long, slender, and about two-fifths as broad as the outer; both are surmounted by curved spines; the latter has twelve and the former four, each of which is slightly ciliate distally. Second maxillæ with three lobes of nearly equal breadth, and attaining to the same level at their summit; each terminates in a series of more or less pectinated spines, those on the outer lobe being the longest.

Superior lobe of the second joint of the maxillipedes equal in breadth and length to the inferior portion; the broad subtruncated apical margin bears about eighteen short spines, each of which bordered laterally by a few small, weak spinules; the inner border carries a stout, curved filament at about its distal third. Palp about equal in length to the preceding joint; first joint very small; second, third and fourth with a superior lobe; fifth cylindrical; the lobes and the last joint are tipped with long simple setæ; the third and fourth joints are subequal in length, and the second is nearly equal in length to the three following joints combined.

The peduncle of the first pleopods is about twice as wide as long, and bears on its inner distal angle a series of stout spines, which have a slight excavation near the apex and a blunt hook-like process at the tip. Inner ramus broad at the base, tapering to an evenly rounded summit. Outer ramus ovate, twice as long as broad, with an angular lobe at the external base. The inner ramus of the second pleopods is a little broader than that of the first, and carries on its inner base a long subulate stylet; the latter is about twice as long as the ramus; the basal third is slightly swollen; the remaining two-thirds is cylindrical and acutely pointed. The rami of the first three pairs of pleopods are clothed at their bases with simple hairs, and their margins with closely placed plumose setæ. The outer rami of the third, fourth and fifth pairs have a sutural line below the apex; the fifth is broad and thickened at the summit; there is a rounded tubercle at the inner distal extremity of the suture, a second one almost in contact, and a third one seated on a short peduncle at some distance below. The swollen distal margin and the tubercles are covered with closely placed rasp-like teeth.

Length of larger specimen (rostrum excluded)...	20 mm.
„ „ rostral spine	10 „
„ „ lateral spine	6 „

Two male examples are in the collection, one obtained at Newcastle Bight and the other off Port Hacking, in 10 to 38 fathoms.

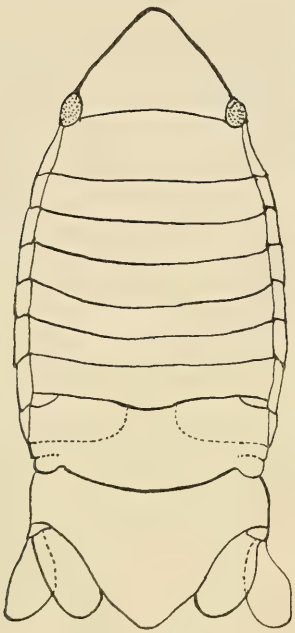
CERCEIS, *H. Milne-Edwards.*

CERCEIS NASUTA, sp. nov.

(Figs. 36*a-b*.)

Stations 55, 57.

Adult female—Body more than twice as long as broad, surface covered with very minute reticulated ridges surmounted with small scattered granules. Cephalon triangular in outline, with a median convex process, which descends in front to between the bases of the first antennæ. The sides of the head are inflexed inferiorly, and gradually converge from the eyes to the base of the descending frontal lobe. First segment of the paraeon about one-third shorter than the length of the cephalon, and almost equal to any two of the six segments following. Pleon equal in length to the peraeon without the first segment; the penultimate segment is well marked from the telson, and bears faint traces of the lines of coalescence; laterally it is ornamented with two broad transverse ridges, each of which bears eight or nine smaller longitudinal ridges, which are studded with granules, the latter increase in size as the ends of the ridges are approached. Terminal segment strongly convex, with three ill-defined granular elevations, the median one often with a rounded notch; sides converging to the extremity, the latter exhibits a small narrow incision, which is not visible from above. Side plates of the peraeon sharply defined and strongly inflexed, the first produced anteriorly to beyond the eyes; the posterior lateral angles of the first to the fourth are subacute with oblique borders; fifth and sixth long, acute, and directed backwards; the seventh has the extremity rounded.

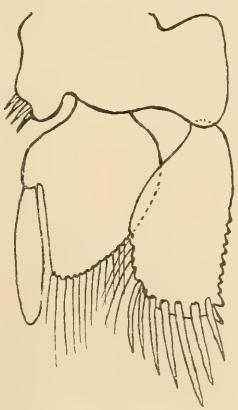


BODY VIEWED FROM ABOVE.
Fig. 36*a*

Eyes small, situated at the postero-lateral angles of the cephalon. First antennæ with the basal joints stout, the first less than twice as long as broad, with the basal half swollen. Second joint a little longer than broad, its length being about equal to the median diameter of the first; third joint narrow and

much longer than the second. Flagellum six articulate, the first and second joints subequal, the third is the longest. Peduncle of second antennæ slightly longer than the flagellum; the first joint stouter, and a little shorter than the second; third joint equal to the two preceding, but much shorter than the fourth. Flagellum with ten joints, the first and second equal; and twice as long as the fourth, which is the shortest in the basal two-thirds. Mandibles stoutish, strongly bent in their distal half. Cutting edge tridentate, with an accessory three-tooth lobe, scarcely inferior in size to the apical process, at the base of which there are seven or more curved spines, bearing uniserial spinules. Molar tubercle well defined, acutely produced below and encircled with spines. Palp three-jointed, the first nearly one-third longer than either of the two succeeding. The first maxillæ have the inner branch narrow and tipped with branched setæ; the outer branch is rather stout, and bears about ten curved spines at its summit; the inner series are furnished with denticles along their apical margins. Second maxillæ with the inner lobe slightly longer and broader than the outer.

First pair of legs short and stouter than those following; second joint of all the legs, except the last, very broad, with a keel-like margin, which is often interrupted in the middle. The propodal joints are long, and exceed any of those preceding, except the second. The last joint has a single stout setæ between the two very unequal spines at its extremity. The fourth and sixth joints of the first pair of legs are armed inferiorly with a series of small spinules; the fifth and sixth has, in addition, a long spine on the distal extremity. The inner ramus of the first pair of pleopods is subtriangular, and much wider than high; the outer ramus oblong, with a subtruncated summit. The inner ramus of the second pair is rather larger than that of the first; the outer ramus is oblong, and tipped with six or seven stout spines, and a spiniform process on the outer distal angle. The marginal setæ of the first three pairs are all strongly developed; there is no sutural line in the outer rami of the third pair, and both rami of the fourth and fifth have branchial pleats. The rami of the uropods are subequal in length and breadth. Since the above was written a single male example has been found. It differs from the female in having the last segment of the peræon longer, with the granuliferous ridges of the pleon more distinctly developed and becoming spinulous. The posterior border of the

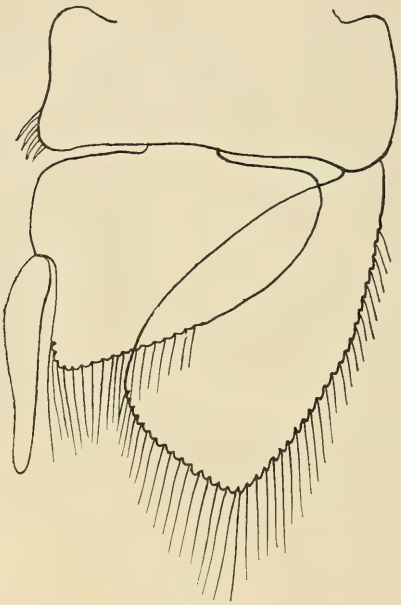


Second Pleopod.
Fig. 36*b*.

last segment exhibits three spiniform denticles, the middle one being the shortest. The outer rami of the uropods are longer than the inner, and both have their distal borders armed with four or five spinules.

Total length of body	6 mm.
Breadth	3 ,,

Obtained off Crookhaven River and Wata Mooli.



SECOND PLEOPOD OF
Cerceis trispinosa, Haswell.
Fig. 37.

CHITONOPSIS, gen. nov.

Body ovate-oblong, slightly convex mesially. The basal joints of the first antennæ, cephalic process, epimera, and uropods are more or less lamellate, and have their contiguous borders adapted to each other, the whole combined forming a thin dilated and subcontinuous border.

Cephalon wider than long, with the antennary sternum produced into a long projecting spatulate plate.

Epimera of the peraeon and pleon greatly produced, with obliquely truncated borders. The anterior margins of the epimera of the first segment are adapted to posterior borders of the expanded sides of the cephalon. Terminal segment of the pleon with a round entire border.

Eyes dorsal, posteriorly imbedded in the first peraeon segment.

First and second joints of the first antennæ foliate; third joint small, cylindrical, terminating in a minute flagellum.

Second antennæ reaching to the external angle of the first peraeon segment; first and second joints short; third, fourth, and fifth compressed, but not dilated. Flagellum much shorter than the peduncle.

Mandible straight, with the cutting edge dentate; molar tubercle well defined; palp strongly developed, and three-jointed. First maxillæ subequal in width; outer lobe tipped with spines, some of which bear minute spinules; inner lobe furnished with four stout branched setæ. Second maxillæ with the lobes short, broad, and subequal; inner lobe with numerous pectinated spines, and the outer pair clothed apically with simple setæ.

Maxillipedes well developed. Palp with low, superior setiferous lobes. First pair of legs weak, the second and succeeding pairs gradually becoming more robust to the seventh.

Pleopods foliate; the inner rami of the fourth and fifth pairs are without internal pleated folds, and the outer rami are destitute of sutural lines.

Uropods lamellate, second joint small, received into an excavation between the flattened lobes of the first.

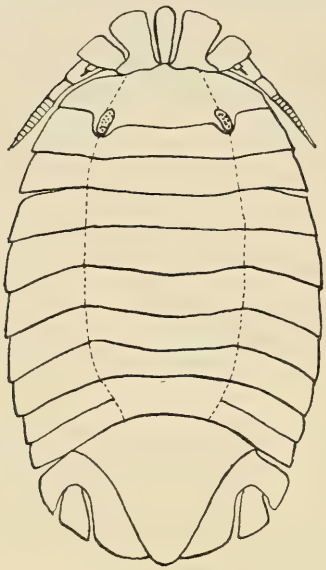
CHITONOPSIS SPATULIFRONS, sp. nov.

(Figs. 38*a-g*.)

Stations 34, 44, 53.

Body depressed; about two-fifths longer than broad. The frontal process, basal joints of the first antennæ, side plates and

uropods are all greatly produced; the whole combined forms a symmetrical oval, with a thin subcontinuous and densely ciliated border.



BODY VIEWED FROM ABOVE.
Fig. 38*a*.

The general appearance of the body is somewhat similar to that of a small *chiton*.

The cephalon is slightly convex centrally, and about two-thirds broader than long. The frontal region exhibits a quadrate median process; the submedian border is sinuate; the antero-external border is evenly curved, and terminates at the pointed extremities of the epimera-like sides of the head.

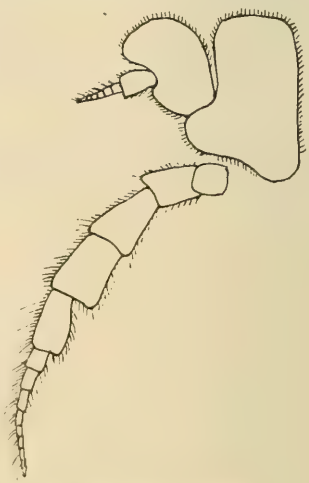
First segment of the peraeon is short in the middle line, but long at the sides; the second to the seventh segments are subequal in length. Pleon as long as the six preceding segments combined. The penultimate segment exhibits on each side a pair of well-defined side plates. The terminal segment is mesially convex, with the antero-lateral angles acute, the sides converging, and the posterior border rounded.

The whole of the epimeral processes are more or less obliquely truncated.

Eyes dorsal, subreniform, the posterior third deeply imbedded in anterior margin of the first peraeon segment.

The first antennæ have the first two joints greatly dilated, and project beyond the frontal margin. The anterior borders are strongly ciliated; the third joint is minute, and terminates in a very short flagellum with six articulations.

Peduncle of superior antennæ compressed, but not dilated; the first two joints are short, third joint widening to the apex; fourth



FIRST AND SECOND ANTENNÆ.
Fig. 38*b*.

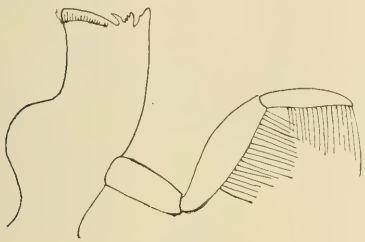
joint about one-third longer than broad ; fifth joint equal to the fourth, and somewhat narrowed at the base.

Flagellum with from nine (female) to twelve (male) articulations, the third being much the longest.

All the joints of the peduncle and the proximal half of the flagellum are densely ciliated, and also exhibit numerous long scattered setæ.

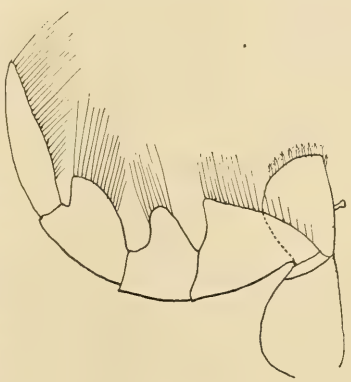
The cephalon is furnished with a spatuliform process : this is widely bifurcated at its base, and embraces the anterior portion of the epistomial plate ; from the lower third its width gradually increases to near the rounded summit. The process is equal in length to the cephalon, and its projection anteriorly equals that of the basal joint of the first antennæ.

Mandibles straight, moderate in size, the cutting edge bi- or tridentate, with two or three stout denticles and several strongly curved spines at its inner base. Molar tubercle distinct, attaining to the same level as the apical denticles ; the margin is encircled with spinules. Palp three-jointed, the second much the longest. First maxillæ subequal in width; the outer lobe with about ten slightly-curved spines, some of which exhibit from three to five minute lateral denticles. Inner lobe with four stout pectinated setæ at the summit The second maxillæ have the lobes subequal in width, and attain to the same level. The inner lobe is rounded at the apex, and bears twenty or more pectinated setæ; the apices of the outer lobes are obliquely truncated, and tipped with numerous stout setæ.



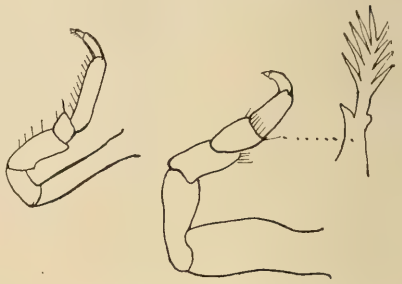
Mandible.
Fig. 38*c*.

The maxilipedes have the second joint tipped with numerous pectinated spines, and the inner border bears a short filament, with a dilated apex. Palpi five-jointed ; the third shorter than the one preceding or following ; the last joint is the longest ; the superior setiferous lobes are rather low.

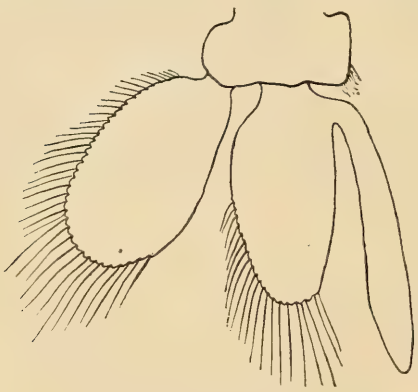


Maxillipedes.
Fig. 38*d*.

First pair of legs slender, the succeeding pairs increasing in size to the seventh. The fourth, fifth and sixth joints of the first pair are armed inferiorly with numerous stoutish pectinated spines; the fourth joint has four or five similar spines on the superior distal border, and the last joint has an accessory spine at the base of the strongly curved claw; the inferior border exhibits a stoutish spine, with a series of uniserial spinules which diminish in size as the base is approached. Stout pectinated spines are present on the superior distal borders of the fourth joint of all the legs; the second to the seventh pairs of legs have an encircling series of similar spines situated on the distal margin of the fifth joint. Peduncles of the pleopods with several prominent spines on the interno-distal angle. The outer rami of the first and second pairs are ovate; the inner rami are oblong, with straight inner margins. The third pair has the outer rami broadly ovate and sparsely ciliate at the distal borders; the sutural line in the outer ramus is faintly indicated at the sides. The fourth and fifth pairs have their rami of subequal size and shape; the outer rami are without sutural lines, and the inner rami are destitute of pleated folds. The outer ramus of the fifth pair has the inner margin armed with three isolated patches of rasp-like teeth, one in the middle, another at the distal third, and the last near the apex.



First and Fourth Legs
Fig. 38*e*.



Second Pleopod.
Fig. 38*f*.

The uropods have the basal joint bifurcate, the external lobe is directed outwards, the inner lobe backwards, the somewhat

cuneate second joint is situated in the V-shaped excavation between the lamellate lobes of the first.

Total length of male ... 13 mm.
Breadth ... 8 „
Total length of female ... 15 „
Breadth ... 9 „

The male differs from the female in having the second antennæ longer; they reach to the end of the second segment of the peraeon, and the flagellum has twelve joints, whilst the female has only nine.

Obtained off Port Jackson, Coogee, and Crookhaven River.

Outer Ramus of Fifth Pleopod.
Fig 38*f*.

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AUSTRALIAN MUSEUM, SYDNEY.

MEMOIR IV.

SCIENTIFIC RESULTS

OF THE

TRAWLING EXPEDITION

OF

H.M.C.S. "THETIS,"

OFF THE COAST OF NEW SOUTH WALES,

IN

FEBRUARY AND MARCH, 1898.

PART 5.—Published 29th July, 1902.

PUBLISHED BY ORDER OF THE TRUSTEES.

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SYDNEY, 1902.

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Total length of male	...	13 mm.
Breadth ...	...	8 ,,
Total length of female	...	15 ,,
Breadth ...	...	9 ,,

The male differs from the female in having the second antennæ longer; they reach to the end of the second segment of the peraeon, and the flagellum has twelve joints, whilst the female has only nine.

Obtained off Port Jackson, Coogee, and Crookhaven River.

Outer Ramus of Fifth Pleopod.
Fig 38*g*.

MOLLUSCA.

PART I.

By CHARLES HEDLEY,

Conchologist, Australian Museum.

BRACHIOPODA AND PELECYPODA.

MOLLUSCA.

PART I.

By Charles Hedley,

Conchologist, Australian Museum.

BRACHIOPODA AND PELECYPODA

PART I.

As explained by Mr. E. R. Waite in the Introduction to this Memoir, the object of the Trawling Expedition was primarily the capture of food fishes, biological investigation taking a second place. Except a few of great bulk, the Mollusca, by reason of their small size, escaped the meshes of the trawling net. At two stations only, Nos. 13 and 49, did our colleague succeed in procuring small quantities of the sea bottom. These have yielded most of the material dealt with in the following pages.

Since the "Thetis" reached in water from 20-80 fathoms, a region almost unknown to Australian investigators, it follows naturally that a high percentage of the species taken is new to science. The known species are those which extend upwards to the littoral zone on this coast, or those which frequent shoal water in Tasmania. To the latter apply the law enunciated by Forbes,* that "parallels in latitude are equivalent to regions in depth." This truth so amply demonstrated for the northern hemisphere, is here first established for Australian waters.

My acquaintance with Australian Tertiary mollusca is too slight to permit a full comparison, but I am within the mark in stating that the collection here dealt with presents a closer relation to the Tertiary fauna than any recent shells yet examined. Survivors specifically unchanged are *Trigonia margaritacea*, var. *acuticostata*, McCoy, *Nucula obliqua*, Lamarck, *Limopsis tenisoni*, Ten. Woods, and *Sarepta obolella*, Tate. The fossil *Pecten polymorphoides*, Zittel, is hardly to be distinguished from

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* Forbes—Rep. Brit. Assoc. for 1843 (1844), p. 175.

Chlamys fenestrata, Hedley. The Eocene *Dimya sigillata*, Tate, corresponds to the recent *D. corrugata*. Though not represented in the collection here discussed, two other recent New South Wales bivalves may be referred to: *Cardium bechei*, Reeve, which is barely separable from the Eocene *C. antisemigranulatum*, McCoy, by the reversed cardinal teeth; and *Cucullæa concamerata*, Martyn, doubtfully distinct from *C. corioensis*, McCoy.

The above facts suggest certain inferences. Firstly, that such beds as the Eocene of Muddy Creek, Victoria, represent a fauna of the hundred fathom zone; and that if the age of the Tertiary beds are to be calculated by Lyellian percentages, an exploration of the hundred fathom zone in existing Australian seas must precede an estimation of the dates of Australian Tertiaries. Secondly, that some living representatives of the Eocene Mollusca of Victoria now dwell six or seven degrees north of where their predecessors lie; a conclusion agreeable to the hypothesis that the Eocene climate was warmer than the present.

In this Report strange names frequently replace familiar ones. The Pelecypoda of New South Wales have heretofore been named according to the lists published by Angas, in the Proceedings of the Zoological Society, and by Smith, in the Reports of the Challenger Expedition. Neither of these writers paid much regard to priority of nomenclature, and many of the names they selected must now pass into synonomy.

In preparing this Report I have been greatly aided by the help of a volunteer assistant, Mr. H. L. Kesteven, to whom my thanks are due for the laborious work of separating and sorting the small shells from the dredgings.

BRACHIOPODA.

Family TEREBRATULIDÆ.

TEREBRATULINA, *D'Orbigny.*

TEREBRATULINA CANCELLATA, *Koch*, sp.

Terebratula cancellata, Koch, Conch. Cab., vii., 1843, p. 35, pl. 26*b*, f. 11-13. *Terebratulina cancellata*, Davidson, Trans. Linn. Soc., iv., 1886, p. 35, pl. vi., f. 1-8.

Station 46.

One specimen from 50-66 fathoms off Jibbon.

LIOTHYRIS, *Douvillé.*

LIOTHYRIS UVA, *Broderip*, sp.

Terebratula uva, Broderip, Trans. Zool. Soc., i., 1853, p. 142, pl. xxii., f. 2.

Liothyris uva, Davidson, Trans. Linn. Soc., iv., 1886, p. 10, pl. ii., f. 5-7.

Stations 44, 56.

A few specimens were secured off Coogee in 49-50 fathoms, and one individual off Botany Bay in 79-80 fathoms.

MAGELLANIA, *Bayle.*

MAGELLANIA FLAVESCENS, *Lamarck*, sp.

Terebratula flavescens, Lamarck, Anim. s. vert., iv., 1819, p. 246.

Waldheimia flavescens, Davidson, Trans. Linn. Soc., iv., 1886, p. 41, pl. vii., f. 6-19.

Station 55.

One specimen was obtained from 11-15 fathoms, off the Crookhaven River.

Family RHYNCHONELLIDÆ.

ATRETIA, *Jeffreys.*

ATRETIA BRAZIERI, *Davidson.*

Atretia brazieri (Davidson), Crane, Proc. Zool. Soc., 1886, p. 183; *Id.*, Trans. Linn. Soc., iv., 1887, p. 175, pl. xxv., f. 16-17.

Stations 13, 49.

Numerous separate valves were taken off Port Kembla in 63-75 fathoms, and a few off Cape Three Points in 41-50 fathoms.

PELECYPODA.

Family NUCULIDÆ.

PRONUCULA, gen. nov.

This genus differs from *Nucula* by having the hinge line arched instead of angulated, the rows of teeth do not meet or overlap beneath the umbones, but are distant from the chondrophore, which is not oblique as in *Nucula*, but perpendicular. Briefly, the constituents of the hinge, which in *Nucula* are much compressed and perhaps slightly rotated, are here wide spread. The shell has not the trigonal contour of *Nucula*, is far thinner and the radial sculpture more pronounced than in that genus. Neither lunule nor escutcheon are present.

Type *Pronucula decorosa*, Hedley.

PRONUCULA DECOROSA, sp. nov.

(Fig. 39.)

Station 49.

Shell small, ovate-oblong, moderately inflated, very inequilateral, thin, closed, covered by a dense, tough, brown epidermis, on which numerous pustules are irregularly arranged. Beneath the epidermis the shell is white, glossy and brilliantly nacreous. Sculpture: until about one-third grown, the shell is rather smooth; after that stage, about thirty fine radiating riblets arise and traverse the whole valve, except a small anterior and posterior space; these are over-ridden by fine close concentric hair lines, which extend the whole length of the valve. Ventral margin rounded, denticulate by the radial riblets. Beak prominent, bear-

PRONUCULA DECOROSA.
Fig. 39.

ing a conspicuous prodissoconch on the summit, situated at a third of the shell's length from the posterior end. Hinge plate arched; chondrophore projecting, almost symmetrical and perpendicular, distant from the teeth. On the anterior side five, on the posterior four, well developed teeth, besides a rudimentary tooth at the conclusion of each series. Apparently a thin amphidetic ligament exists, but I could not assure myself of this feature. Pallial line indistinguishable. Length, 2·5; height, 2; breadth of single valve, ·7 mm.

Two complete specimens and a few separate valves were taken off Port Kembla in 63-75 fathoms.

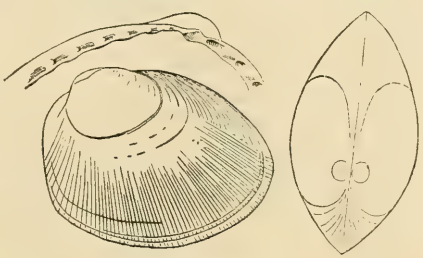
PRONUCULA MINUTA, *Ten. Woods*, sp.

Nucula minuta, Ten. Woods, Proc. Roy. Soc. Tas. for 1876 (1877), p. 156 [not *N. minuta* of Philippi, Gould, or Montagu.]

(Fig. 40.)

Station 49.

I have identified this species by comparison with the author's types, kindly lent me by Mr. A. Morton, the Curator of the Tasmanian Museum. The "Thetis" shell here figured is 1·6 mm. long and 1·2 high; whether it is adult or not my series is insufficient to decide, but I incline to the opinion that it is. Tate and May have united this* with *N. antipodum*, Hanley, and *N. micans*, Angas. As the species of Woods does not agree with the descriptions of Hanley or Angas, or with specimens determined as *antipodum* and *micans* respectively, their conclusions are not here accepted.



PRONUCULA MINUTA.
Fig. 40.

A few examples which the "Thetis" took came from off Port Kembla in 63-75 fathoms.

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* Tate & May—Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 435.

NUCULA, *Lamarck.*

NUCULA OBLIQUA, *Lamarck.*

Nucula obliqua, Lamarck (not Hanley, Smith, &c.), Anim. s. vert., vi., 1, 1819, p. 59; *Id.*, Chenu, Man. Conch., ii., 1862, p. 179, f. 897. *N. tenisoni*, Pritchard, Proc. Roy. Soc. Vic., viii., 1896, p. 128.

Station 49.

Lamarck notes that his species was gathered at the "Cap aux Huitres," by Peron. There can be no reasonable doubt that this place is Oyster Bay, Maria Island, Tasmania, where Peron made a large collection of shells in February, 1802. The "Thetis" shells, taken off Port Kembla in 63-75 fathoms, are so named because they correspond not only with Lamarck's description and Chenu's figure of the type, but also with specimens from the Derwent River, Tasmania, presented by Mr. W. L. May. But if they are rightly regarded as *N. obliqua*, it follows that Lamarck's species has been misinterpreted by all later writers.

An allied species has been mistaken for *N. obliqua* by Hanley and Smith.* It is common off the coast of tropical Queensland, in a depth of about 20 fathoms. Whereas Lamarck describes the shell from the Cap aux Huitres as thin, with "margine integerrimo," and 11 mm. long, the Queensland shell is very solid and the margin is microscopically crenulated, and it is the largest living species. I have taken it off the Palm Islands, 20 mm. long, and Dr. Coppinger's specimens from the Arafura Sea reached 28 mm. The northern species is longer in proportion to height than the Tasmanian, and differs by having just anterior to the long row of teeth a slight but constant inflexion of the dorsal margin. I propose to distinguish the Queensland species as *Nucula superba*, *nom. mut.*

After re-examining the question, the Curator (Mr. R. Etheridge, Junr.), and I support Mr. G. B. Pritchard in considering that there is no specific difference between *N. obliqua*, as here identified, and the Eocene fossils described by Tenison Woods as *N. tumida*.† Mr. R. Etheridge, Junr., has already pointed out‡ that the name *N. tumida* was preoccupied by Phillips.§ Pritchard adds that

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* Hanley—Thes. Conch., 1860, iii., p. 156, pl. ccxxx., f. 150; Smith—Chall. Rep., Zool., xiii., 1885, p. 225.

† Ten. Woods—Proc. Roy. Soc. Tas. for 1876 (1877), p. 111.

‡ Etheridge—Cat. Australian Fossils, 1878, p. 155.

§ Phillips—Illustr. Geol. Yorkshire, 1836, pt. 2, pl. 5, f. 15.

it was also preoccupied by Hinds,* and on that account has proposed for it the name of *N. tenisoni*.†

Off Port Kembla in 63-75 fathoms.

Family LEDIDÆ.

LEDA, *Schumacher.*

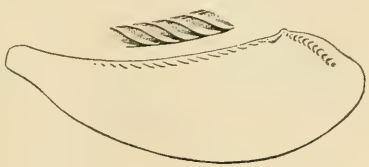
LEDA ENSICULA, *Angas.*

Leda ensicula, Angas, Proc. Zool. Soc., 1877, p. 177, pl. xxvi., f. 27; *Id.*, Smith, Chall. Rep., Zool., xiii., 1885, p. 239.

(Fig. 41.)

Station 49.

Smith writes of this: "Its form is so peculiar, and the description given by Angas so good, that there is little fear of its being confounded with any other species. I may mention that the teeth, which are not referred to by Angas, are elongate, very acute, and numerous, especially on the rostral side."



LEDA ENSICULA.
Fig. 41.

What seemed improbable to Smith has actually happened. Tate and May‡ have united this with *Leda lefroyi*, Beddome. The two species can hardly, if at all, be separated from the external aspect of the valves Smith's observations on the hinge enables me to recognise *L. ensicula*. The posterior, but not the anterior, half of the hinge corresponds with that figured and described by Tate§ for his genus *Poroleda*.

Numerous examples were taken off Port Kembla in 63-75 fathoms.

LEDA LEFROYI, *Beddome.*

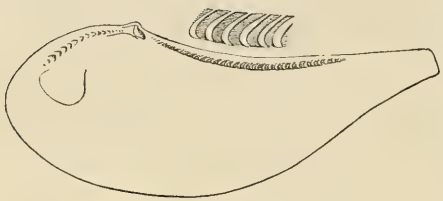
Leda lefroyi, Beddome, Proc. Roy. Soc. Tas. for 1881 (1882), p. 21.

(Fig. 42.)

Station 49.

By the courtesy of Mr. A. Morton, Curator of the Tasmanian Museum, I am enabled to identify this species from Beddome's type.

* Hinds—Proc. Zool. Soc., 1843, p. 98.
† Pritchard—Proc. Roy. Soc. Vic., viii., 1896, p. 128.
‡ Tate & May—Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 435.
§ Tate—Proc. Roy. Soc. N.S.W., xxvii., 1893, p. 186.



LEDA LEFROYI.
Fig. 42.

L. lefroyi differs from the foregoing species in the posterior hinge, whose teeth are more bent, more numerous and less oblique to the dorsal margin. To better explain the difference I offer a sketch of each.

Several separate valves occurred off Port Kembla 63-75 fathoms.

LEDA CRASSA, *Hinds*, sp.

Stations 13, 49.

Nucula crassa, Hinds, Proc. Zool. Soc., 1843, p. 99; *Leda crassa*, Hanley, Thes. Conch., iii., 1860, p. 120, pl. 228, f. 69; *Id.*, Sowerby, Conch. Icon., xviii., 1871, Leda, pl. v., f. 27; *Id.*, Angas, Proc. Zool. Soc., 1877, p. 193; *Id.*, Smith, Chall. Rep., Zool., xiii., 1885, p. 237; *Id.*, Tate & May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 435.

Leda chuva, Gray, Voy. Fly, ii., 1847, p. 360, pl. ii., f. 3; *Id.*, Hanley, *op. cit.*, p. 119, f. 67; *Id.*, Sowerby, *op. cit.*, f. 46.

Numerous separate valves were found off Port Kembla in 63-75 fathoms, and off Cape Three Points in 41-50 fathoms.

LEDA DOHRNI, *Hanley.*

Leda dohrni, Hanley, Proc. Zool. Soc., 1861, p. 242; *L. dohrnii* (A.Ad.), Sowerby, Conch. Icon., xviii., 1871, Leda, pl. ix., f. 54.

Leda hanleyi, Angas, Proc. Zool. Soc., 1873, p. 174, pl. xx., f. 7.

Stations 29, 49.

The specimens collected indicate that the form described by Angas is the adult of Hanley's species.

This species occurred, but more rarely than *L. crassa*, off Port Kembla, 63-75 fathoms; also at 18 fathoms, Manning Bight.

LEDA MILIACEA, sp. nov.

(Fig. 43.)

Stations 13, 49.

Shell small, solid, rather inflated, anterior side the longer, posterior slightly rostrate, umbo prominent. Externally smooth and glossy, with faint growth striæ. Colour pale yellow. Teeth of the pattern of *L. crassa*, 9 on the posterior, 12 on the anterior side.

Length, 2·25 ; height, 1·5 mm.

From all known Australian species the present may be readily known by its smoothness and small size.

LEDA MILIACEA.
Fig. 43.

Numerous separate valves were taken off Port Kembla in 63-75 fathoms, and off Cape Three Points in 41-50 fathoms.

SAREPTA, *A. Adams.*

SAREPTA OBOLELLA, *Tate*, sp.

Leda obolella, Tate, Trans. Roy. Soc. S.A., viii., 1886, p. 129, pl. v., f. 3*a-b*.

Sarepta tellinæformis, Hedley, Rec. Aust. Mus., iv., 1901, p. 26, f. 8.

Stations 13, 49.

Mr. T. S. Hall has kindly sent me a series of *Leda obolella*, Tate, from the Eocene beds of Clifton Bank, Muddy Creek, Victoria, and suggested a relationship with my *S. tellinæformis*.

The different stages of growth differ in the proportions of length to depth and height ; adult specimens also vary in contour, so that it is not easy to institute exact comparison. There is, however, one valve among the fossils which so nearly matches my type that I am satisfied to withdraw my specific name. I would, however, retain the genus to which I assigned it. Among the "Thetis" shells a pair of valves was found connected by an external ligament. This fact dissipates the doubt I previously expressed in using the name *Sarepta*.

The "Thetis" took this off Port Kembla in 63-75 fathoms, and off Cape Three Points in 41-50 fathoms.

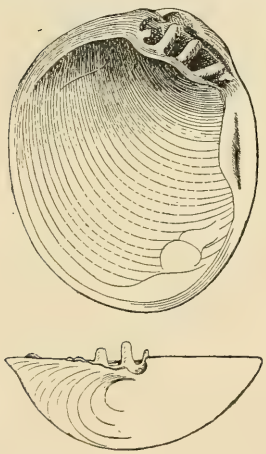
CYRILLA, *A. Adams.*

CYRILLA DALLI, sp. nov.

(Fig. 44.)

Stations 13, 49.

Shell minute, inflated, oblique, produced on the posterior ventral side, glossy, slightly concentrically striated. Colour white, under a thick, horny, brittle, brown epidermis, substance slightly nacreous. Umbones obtuse, rather distant Chondrophore a deep triangular pit under the umbo, posterior to which is a long, narrow groove, apparently for the reception of the ligament. Hinge plate broad and short, projecting below, bearing three long, narrow, outstanding cardinals, and on either side of these a rudimentary tooth. Left valve with a long, strong posterior lateral tooth, received into a deep socket in the right. The pallial line is slightly sinuate on approaching the posterior adductor scar, which is low down and well developed. Margin of valve smooth and bevel-edged. Length, 1·2; height, 1·05; depth of single valve, ·35 mm.



CYRILLA DALLI.
Fig. 44.

This species, the third and smallest *Cyrilla*, adds a genus to the Australian fauna. It is named for Dr. W. H. Dall, as a slight but grateful acknowledgment of the help which his "Tertiary Fauna of Florida" has been to me in studying this and other forms. My illustration shows the left valve from above and from within.

Many separate valves, and a few coloured and in contact, were taken off Port Kembla in 63-75 fathoms, and off Cape Three Points in 41-50 fathoms.

Family LIMOPSIDÆ.

LIMOPSIS, *Sassi.*

LIMOPSIS TENISONI, *Ten. Woods.*

Limopsis tenisoni, Ten. Woods, Proc. Roy. Soc. Tas. for 1877 (1879), p. 56 ; *L. cancellata*, Ten. Woods, Proc. Roy. Soc. Tas. for 1876 (1877), p. 156 [not *L. cancellata*, Reeve, nor ? *L. cancellata*, Martens, S. B. Nat. Freunde, 1881, p. 66.]

L. bassi, Smith, Chall. Rep., Zool., xiii., 1885, p. 256, pl. xviii., f. 6.]

Station 49.

Having studied both the type of *L. tenisoni*, in the Tasmanian Museum, and "Challenger" specimens of *L. bassi*, I am in a position to say that these names are synonymous. Tate and May* catalogue this species as *L. multistriata*, Forskal,† but that species, judging from figures, is more symmetrical. It has been identified by McCoy‡ as *L. belcheri*, Adams & Reeve, an identification emphatically denied by Tate.§

The "Thetis" procured this species off Port Kembla in 63-75 fathoms.

LIMOPSIS BRAZIERI, *Angas.*

Limopsis brazieri, Angas, Proc. Zool. Soc., 1871, p. 21, pl. 1., f. 34.

Station 49.

Several specimens off Port Kembla in 63-75 fathoms.

LIMOPSIS RUBRICATA, *Tate.*

Limopsis rubricata, Tate, Trans. Roy. Soc. S.A., ix., 1887, p. 71, pl. 5, f. 6.

Station 13.

A couple of valves from 41-50 fathoms, off Cape Three Points.

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* Tate and May—Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 437.

† Chenu—Man. Conch., ii. p. 177, f. 881, 1859.

‡ McCoy—Ann. Mag. Nat. Hist., (3), xvi., 1865, p. 114.

§ Tate—Trans. Roy. Soc. S.A., xxi., 1897, p. 49.

AUSTROSAREPTA, *Hedley.*

AUSTROSAREPTA PICTA, *Hedley.*

Austrosarepta picta, Hedley, Proc. Linn. Soc. N.S.W., xxv., 1899, p. 430, f. 1, 2.

Station 49.

Three single valves from off Port Kembla in 63-75 fathoms.

Family ARCIDÆ.

BATHYARCA, *Kobelt.*

BATHYARCA PERVERSIDENS, sp. nov.

(Fig. 45.)

Stations 13, 49.

Shell small, short, trapezoidal, solid, inflated, slightly inequilateral, rounded anteriorly and posteriorly, slightly sinuate at the byssal gape, a faint depression extending from the gape to the beaks, which are prominent. Sculpture: fine radial riblets, about their own breadth apart, here and their surmounted by short scales, are traversed and broken by concentric growth furrows. Ligamental area narrow. Hinge line straight, narrow and vertically striated for the median third, broadened at either end, anteriorly with two, posteriorly with four irregularly horizontal or oblique striated teeth. Margin crenulated within, except around the byssal gape. Length, 3·25; height, 2·5 mm.

BATHYARCA PERVERSIDENS.
Fig. 45.

This species is included in the genus *Bathyarca*, named by Kobelt,* and defined by Verrill & Bush.†

Separate valves occurred plentifully off Port Kembla in 63-75 fathoms, and off Cape Three Points in 41-50 fathoms.

* Kobelt—Conch. Cab., viii., 2, Arca, 1891, p. 213.
† Verrill & Bush—Proc. U.S. Nat. Mus., xx., 1898, p. 842.

ARCA, *Linné.*

ARCA RETICULATA, *Gmelin.*

Arca reticulata, Gmelin, Syst. Nat., xiii., 6, 1790, p. 3311.

Stations 49, 56.

A few separate valves were taken off Port Kembla in 63-75 fathoms. One adult shell was procured off Botany Bay in 79-80 fathoms.

GLYCYMERIS, *Da Costa.*

GLYCYMERIS AUSTRALIS, *Q. & G.*, sp.

Pectunculus australis, Q. & G., Voy. Astrolabe, iii., 1835, p. 469, pl. 77, f. 7-9.

P. holosericus, Reeve, Conch. Icon., i., Pectunculus, 1843, pl. iv., sp. 18.

P. grayanus, Dunker, Proc. Zool. Soc., 1856, p. 357.

Station 52.

This species was taken by Quoy & Gaimard in 14 fathoms off Cape Dromedary, New South Wales. Though so precisely localised, excellently figured and described, it has been ignored by all subsequent authors.

One specimen was taken in the Shoalhaven Bight, 19-20 fathoms.

Family PTERIIDÆ.

PHILOBRYA, *Carpenter.*

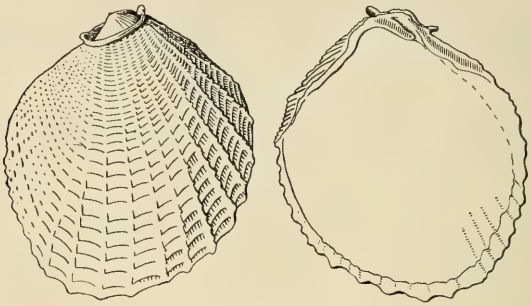
PHILOBRYA PECTINATA, sp. nov.

(Fig. 46.)

Stations 13, 49.

Shell small, thin, rather oblique. Colour white (? bleached). Dorsal margin sloping, posterior and ventral margins rounded, anterior margin sinuate, descending. Prodissoconch of average size. Sculpture about twenty-two sharp, narrow, radiating ribs, crowded posteriorly, apart medially and anteriorly, denticulate the margin, and are intersected by concentric riblets which produce erect scales at the point of contact and enclose nearly square meshes. Within, the margin is narrow, especially anteriorly; the interlocking pits and tubercles upon it are slightly developed, especially anteriorly. In the posterior ventral angle three such

are more prominent, from which ridges and furrows extend upwards into the valve. Chondrophore oblique, submedian.



PHILOBRYA PECTINATA.
Fig. 46.

Byssal notch small. Hinge crenulations well developed both anteriorly and posteriorly. Length, 2 ; height, 2·5 mm.

This species is nearest related to *P. tatei*, Hedley,* from which it is immediately distinguished by the sloping posterior dorsal margin and narrower contour. By the kindness of Mr. J. Dennant I am enabled to compare the novelty with *P. bernardi*, Tate,† which is longer, narrower, more inflated, and has the interior margin broader and more tuberculated than the recent species. The dimensions of *P. bernardi* were not stated in the original description, so this opportunity is taken to note that the co-type from Shelford is 1·9 mm. in length and 2·8 in height.

Several valves from 41-50 fathoms off Cape Three Points, and from 63-75 fathoms off Port Kembla.

PHILOBRYA TATEI, *Hedley.*

Philobrya tatei, Hedley, Rec. Aust. Mus., iv., 1901, p. 24, f. 6.

Stations 13, 49.

Numerous separate valves were taken with the preceding species.

PHILOBRYA CRENATULIFERA, *Tate*, sp.

Myrina crenatulifera, Tate, Trans. Roy. Soc. S.A., xv., 1892, p. 131, pl. i., f. 11, 11*a*.

Stations 13, 49.

One valve was taken at each locality, neither of which showed the characteristic colour of southern specimens.

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* Hedley—Rec. Aust. Mus., iv., 1901, p. 24, f. 6.
† Tate—Trans. Roy. Soc. S.A., xxii., 1898, p. 88, pl. iv., f. 10.

Family TRIGONIIDÆ.

TRIGONIA, *Bruguiere.*

TRIGONIA MARGARITACEA, *Lamarck,* Var. ACUTICOSTATA, *McCoy.*

Trigonia acuticostata, McCoy, Geol. Mag., iii., 1866, pp. 481-2, f. 1.

Trigonia lamarckii, var. *reticulata*, Ten. Woods, Proc. Linn. Soc. N.S.W., ii., 1878, p. 125.

(Figs. 47, 48.)

Stations 13, 49.

The classification of the recent *Trigonia* is a subject of dispute. Several species have been proposed, but no two writers have agreed on their value. A preliminary examination led von Willemoes Suhm to recognise four species.* His notes are probably embodied by Smith.† The references given by the latter writer are not exhaustive, and if his valuation be adopted certain references should, I think, be transferred to the credit of other species.

Tapparone Canefri, who gave the matter considerable attention,‡ concludes that *T. lamarckii*, Gray, is a mere variety of *T. margaritacea*, Lamk.

The study Lycett bestowed on this genus gives especial weight to his opinion. Though he confused the nomenclature of the recent species, his meaning can be recovered from the context. He considered that only two recent species, *T. margaritacea*, Lamk., and the bizarre *T. strangei*, Ad., are valid.§

Having collected *Trigonia* at points of this coast thousands of miles apart, and after careful study of the ample collection in the Australian Museum, I endorse Lycett's opinion.

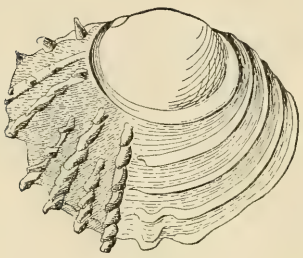
In size, shape, colour and sculpture *Trigonia* is quite inconstant; it matches *Lima* in the variation of the radial ribs and of the warts or spines upon them. In deeper water the shell becomes more spinose, a character upon which McCoy founded his *T. acuticostata*. Tenison Woods bestowed another name upon this form, apparently because his specimens were recent and McCoy's

* Willemoes Suhm—Chall. Rep., Narr., i., 1885, p. 462.
† Smith—Chall. Rep., Zool., xiii., 1885, pp. 224-5.
‡ Tapparone Canefri—Mem. Acad. Sci. Torino, xxviii., 1876, p. 241.
§ Lycett—Monogr. Brit. Fossil Trigoniæ, Palæont. Soc., xxxiii., pt. 5, 1879, p. 232.

were fossil. Subsequent to his description of the species McCoy recognised *T. acuticostata* as living in Bass Straits.*

The series before me well illustrates the early stages of growth. I had remarked on the descrepant sculpture these exhibit, when my friend, Mr. T. S. Hall, informed me that he had simultaneously discovered this interesting feature. He has since published† an excellent account of this, showing how the ornament of Mesozoic ancestors persists in the young of recent *Trigonia*.

A young shell, 1·15 mm. long and 1·05 mm. high, is here shown (fig. 46). The prodissoconch is smooth and inflated with a broad up-turned rim. On the posterior half of the valve are seven radiating spinose ridges, alternately older and younger, two spines corresponding in age to one of anterior concentric lamella, the interstices of the radii, but not of the lamellæ, are finely granulate. At every second lamella a fresh radius arises, and thus retreating step by step the lamellæ shrink till at the tenth they disappear. I find that the brephic stage here described of var. *reticulata* is precisely similar to that of typical *T. margaritacea* and of its other varieties, viz., *nobilis*, Ad., *dubia*, Sowb., *lamarckii*, Gray, and *uniophora*, Gray; also to that of *T. strangei*. All these forms also possess a small chondrophore immediately posterior to the umbo, of which I find no note in literature.



TRIGONIA MARGARITACEA.
Fig. 47.

At its inception the hinge appears to consist of a cardinal and a lateral in the right valve, each fitting into its respective sockets

LEFT VALVE. RIGHT VALVE.
BREPHIC STAGE OF HINGE IN TRIGONIA.
Fig. 48.

in the left. With growth (three stages shown in fig. 47) both cardinal and lateral add cog upon cog, advance and unite to form the adult complex. Corresponding modifications occur in

* Crosse—Journ. de Conch., xxiv., 1876, p. 396.
† Hall—Proc. Roy. Soc. Vic., xiv., 1901, pp. 17-21, text fig.

the left valve. This history disproves the suggestion* that the *Trigonia* hinge is a contraction of an originally taxodont dentition.

Numerous separate valves occurred off Port Kembla in 63-75 fathoms, and off Cape Three Points in 41-50 fathoms.

Family PECTINIDÆ.

PECTEN, *Mueller.*

PECTEN MEDIUS, *Lamarck.*

Pecten medius, Lamarck, Anim. s. vert., vi., 1, 1819, p. 163.

Pecten laticostatus, Gray in Yate, Account of New Zealand, 1835, p. 310 [not *P. laticostatus*, Lamk., Anim. s. vert., vi., 1819, p. 179].

Pecten fuscus (Klein), Sowerby, Thes. Conch., i., 1842, p. 47, pl. xvi., f. 118, 119.

Pecten bifidus, Menke, Spm. Moll. Nov. Holl., 1843, p. 35; *Id.*, Philippi, Abb. Descr., i., 1844, p. 202, pl. ii., f. 6 [not *P. bifidus* (Munster), Goldfuss, Petr. Germ., 1826, p. 65, pl. xcvii., f. 10].

Pecten fumatus, Reeve, Conch. Icon., 1852, pl. vii., f. 32; *Id.*, Smith, Chall. Rep., Zool., xiii., 1885, p. 307.

Pecten novæ-zelandiæ, Reeve, *op. cit.*, pl. vii., f. 36.

Pecten modestus, Reeve, *op. cit.*, pl. xi., f. 41.

Pecten filosus, Reeve, *op. cit.*, f. 42.

Pecten meridionalis, Tate, Proc. Roy. Soc. Tas. for 1886 (1887), p. 115.

? *Pecten concavum*, Perry, Conchology, 1811, pl. iv., f. 1.

? *Pecten excavatus*. Anton, Verzeich., x., 1839, p. 19; *Id.*, Philippi, Abbild. Besch., i., 1844, p. 201, pl. ii., f. 1.

Station 55.

This nomenclature for the common Australian Scallop has not been previously recognised. The inquiry into its right to usage turns on two points—whether the Australian species is identical with that from New Zealand, and what is the proper name for the latter.

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* Fischer—Journ. de Conch., xxxii., 1884, p. 117.

Angas, who had collected the species in both countries, writes that the South Australian *Pecten* "is without doubt the *P. laticostatus* of Gray from New Zealand."* Tenison Woods remarks that the Tasmanian and New Zealand forms can only be parted by those who consider geographic isolation a specific character.† Hutton agrees in uniting the New Zealand species to the Australian.‡

On the other hand, Tate, after mature consideration, ranked the Australian species apart from that of New Zealand.§ This view had by inference the support of Sowerby, Reeve and Smith.

The variations in colour and contour of the Australasian Scallop described by Tate are not, in my opinion, sufficient or persistent enough for specific rank. The Australian and New Zealand shells are, therefore, to be united under one name.

Lamarck gave no locality for his *Pecten medius* when he described it. It has escaped the notice of all conchological writers that Deshayes (who doubtless wrote in view of Lamarck's type) has redescribed *Pecten medius*, and added, "Elle vient des mers de la Nouvelle Zélande, où elle paroit aussi commune que le *Pecten maximus* sur nos côtes."‖

Lamarck had ample collections of the common and conspicuous shells from New Zealand, Tasmania and Southern Australia. That our Scallop had apparently escaped his notice was an anomaly which suggested the present inquiry.

Because Lamarck referred interrogatively to the figure of a shell from the Red Sea, he has been misunderstood as having described Red Sea material. It is beyond the limits of this article to discuss whether the species from the Red Sea and the West Indies, generally known as *P. medius*, is or is not that species. However, that the New Zealand species, and hence the Australian, is the real *Pecten medius*, Lamarck, is certain.

In 11-15 fathoms off the Crookhaven River.

AMUSIUM, *Schumacher.*

AMUSIUM THETIDIS, sp. nov.

(Fig. 49.)

Station 49.

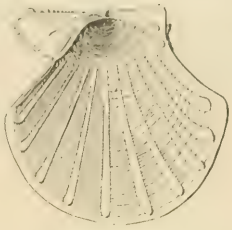
Valve small, thin, white, translucent, compressed, equilateral, externally glossy and concentrically grooved by reverse imbricating sculpture, the internal lyræ visible through the shell. The anterior auricle well developed, without ctenolium. Hinge line long, slightly concave, umbo projecting. Within are ten slender

* Angas—Proc. Zool. Soc., 1865, p. 656.
† Ten. Woods – Proc. Roy. Soc. Tasm. for 1877 (1878), p. 56.
‡ Hutton—Proc. Linn. Soc. N.S.W., ix., 1884 (1885), p. 532.
§ Tate—Proc. Roy. Soc. Tasm. for 1886 (1887), p. 115.
‖ Deshayes—Encycl. Meth., Vers., iii., 1832, p. 715.

raised radiating lyræ, knobbed at the ventral margin and vanishing towards the umbo. A pair of auricular crura occur on either side of the hinge. The hinge plate and ventral margin are roughened by fine vermiculate scratches. Chondrophore minute, triangular, the depth of the hinge plate. Length, 6 ; breadth, 6 mm.

This seems to represent the *A. lucidum*, Jeffreys, of Northern Seas.

One perfect right valve and several fragments were taken off Port Kembla in 63-75 fathoms.



Amusium thetidis.
Fig. 49.

CYCLOPECTEN, *Verrill.*

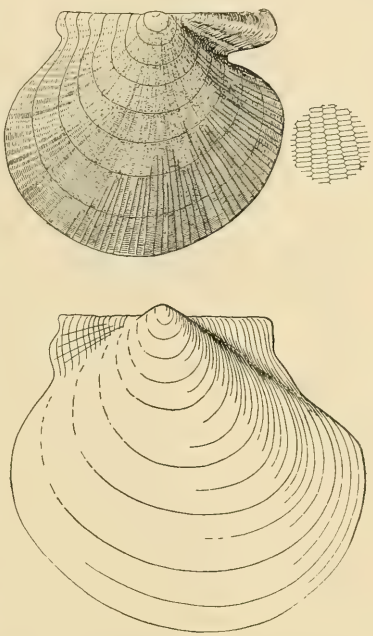
CYCLOPECTEN FAVUS, sp. nov.

(Fig. 50.)

Stations 13, 49.

Valves dissimilar in shape, size and sculpture. The left larger and more convex, thin, opaque white in the centre, transparent at the periphery, smooth except for a few delicate concentric growth lines. Hinge line straight, about two-thirds of the length of the valve; auricles nearly equal, latticed by radiating and concentric threads. Umbo projecting, with a callus crest. Ventral margin rounded, produced posteriorly. Hinge plate narrow, finely wrinkled. Chondrophore small, projecting into the cavity of the valve.

Right valve smaller, overlapped ventrally by its fellow, less oblique, pale yellow, opaque. Umbo not projecting, auricles unequal, the anterior narrow and produced. Beneath it a byssal notch, but no pectinated teeth. Sculptured by concentric growth lines and



Cyclopecten flavus.
Fig. 50.

superficially by numerous fine, irregular, radiating threads, connected by close-set transverse bars which include narrow hexagonal spaces. This structure is seen to peel off in places, and is, therefore, probably epidermial, and perhaps corresponds to the pustules of the Atlantic species.

Left valve, length, 3·2 mm. ; height, 2·7 mm.

Right valve, length, 2·6 mm. ; height, 2·5 mm.

The species is referred to Verrill's genus *Cyclopecten*,* one member of which, *C. murrayi*, Smith,† has already been reported from Australia.

This and the next are readily distinguishable from co-generic forms by their obliquity and the honeycomb structure of the right valve.

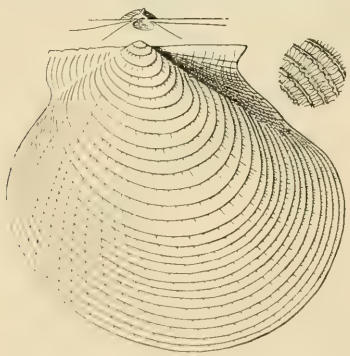
A couple of perfect shells and numerous separate valves were taken off Port Kembla in 63-75 fathoms, and off Cape Three Points in 41-50 fathoms. The Museum contains specimens which Mrs. Helena Forde collected on the beach at Pambula, N.S.W.

CYCLOPECTEN OBLIQUUS, sp. nov.

(Fig. 51.)

Stations 13, 49.

This species is slightly larger than the preceding, which it closely resembles. Without a lens the right valve of *C. obliquus* is indistinguishable from that of *C. favus ;* my drawing would stand equally well for either. Under high magnification, and by transmitted light, the hexagonal spaces in *C. obliquus*, but not in *C. favus*, appear to be stippled. From this cause, by reflected light, the valve of *C. favus* is glossy, that of *C. obliquus* dull.



CYCLOPECTEN OBLIQUUS.
Fig. 51.

The left valve (fig. 50) is easily distinguished by its elevated concentric lamellæ, about 35 in number. Between the lamellæ are irregular veins.

The valve figured is 4·6 mm. in length and 4·2 mm. in breadth.

Numerous separate valves and a perfect specimen occurred off Cape Three Points in 41-50 fathoms, and off Port Kembla in 63-75 fathoms.

* Verrill—Trans. Connect. Acad., x., 1899, p. 70.
† Smith—Chall. Rep., Zool., xiii., 1885, p. 303, pl. xxii., f. 1.

CHLAMYS, *Bolten.*

CHLAMYS ASPERRIMUS, *Lamarck*, sp.

Pecten asperrimus, Lamarck, Anim. s. vert., vi., i., 1819, p. 171; Delessert, Recueil., 1841, pl. xv., f. 1*a-b*.

Stations 49, 55.

Menke mis-identified* this as *Pecten rubidus*, Martyn, a name now included in the synonymy of the Arctic *P. islandicus*, Müller.

In 11-15 fathoms off the Crookhaven River, and off Port Kembla in 63-75 fathoms.

CHLAMYS TEGULA, *Wood*, sp.

Ostrea tegula (Mawe), Wood, Index Test., 1828, p. 206, Suppl., pl. ii. *Ostrea*, f. 3; *Pecten tegula*, Sowerby, Thes. Conch., i., 1842, p. 68, pl. xiv., f. 90.

Station 55.

In 11-15 fathoms off the Crookhaven River.

CHLAMYS FENESTRATA, *Hedley.*

Chlamys fenestrata, Hedley, Proc. Linn. Soc. N.S.W., xxv., 1900, p. 730, pl. xlviii., f. 17-19.

? *Pecten polymorphoides*, Zittel, Reise Novara, Geol., i., 1864, p. 51, pl. xi., f. 3.

Stations 13, 49, 52.

A few broken valves occurred off Port Kembla in 63-75 fathoms, and off Cape Three Points in 41-50 fathoms. From 19-20 fathoms in the Shoalhaven Bight a large specimen was secured, which measured 37 mm. in height and length, and was more oblique than younger shells. In this stage of growth it differs much from the type described, and acquires a close resemblance to the fossil *P. polymorphoides*, Zittel. In view of the geologic importance of the determination, I requested the Curator, Mr. R. Etheridge, Junr., to examine the two shells. Guided by the

* Menke—Spm. Moll. N. Holl., 1843, p. 36.

material on hand, we agree that the minute sculpture of the recent species divides it from the fossil, but in view of the variability of each we regard it as probable that a larger series might bridge the gap.

Mr. Etheridge has kindly drawn up the following detailed comparison :—

"The outline and auricles, cardinal margins, chondrophore, latilaminæ and adductor impressions in each valve are the same in both fossil and recent forms.

Right valves.—The fasciculate primary costæ in both are six in number and rounded. In the recent form the fasciculi are flat, entire and depressed, and are differentiated from one another by faint grooves. In the fossil shell the fasciculi are sharp, each distinctly separated from its neighbours and bifurcate.

The intercostal spaces in the recent shell are traversed by simple secondary narrow costæ. In the fossil these second costæ are similar to the fasciculi of the primaries, and are more numerous than the secondaries of the recent form.

The sculpture of the recent shell consists of almost microscopic, remarkably close, concentric, scobinate frills on the intercostal spaces, reduced to ordinary linear sculpture on the primary costæ. In the fossil the whole of the fasciculi are sub-echinate, and on the anterior end echinate, whilst the intercostal spaces exhibit concentric frills only.

Left valves.—Primary costæ are 6, prominent, of indefinite fascicules, except on the anterior and posterior ends, and are of less width than the intercostal spaces. In the fossil they *may* be 6 and depressed, but the component fascicules sharp.

The intercostal spaces in the recent form bear secondary costæ, which are obliterated by upstanding concentric frills passing equally and uniformly across them and the primary costæ. The fossil appears to have possessed the same sculpture."

From 19-20 fathoms in the Shoalhaven Bight.

DIMYA, *Roualt.*

DIMYA CORRUGATA, sp. nov.

(Fig. 52.)

Station 49.

Shell irregularly trapezoidal, higher than long, obliquely posteriorly produced, both valves shallow, the left or free valve the flatter. In the shade the surface is dull grey, but in reflected light it has a brilliant silvery sheen. Sculpture: close fine concentric growth lines in the early stages are distorted by

the foreign body to which the apex is fixed, radial crenulations early appear, increase by interstitial riblets, and corrugate the margin. Interior with a marginal shelf reached by variable radiating ribs, which are not related to the external sculpture, the ventral distant, the dorsal smaller and closer, sometimes in pairs. Hinge line straight and short, beneath its centre is set the small deep triangular chondrophore. Umbo projecting in the left valve. Height, 12 ; length, 10 mm.

DIMYA CORRUGATA.
Fig. 52.

My material consists of fragments and odd, mostly left, valves. All known *Dimya* are Tertiary fossils except *D. argentea*, Dall,* dredged alive in the West Indies. From that the Australian shell differs by coarser sculpture and fewer internal radii. Two Australian Eocene *Dimya* were published by the late Prof. Tate. *D. dissimilis*,† which has wrinkled hinge areas like *Dimyodon*, and *D. sigillata*‡, apparently from the examples before me, smoother, smaller, and more globose than the recent species.

The interior of the left and the exterior of the right valve are here figured.

Off Port Kembla, 63-75 fathoms.

LIMA, *Bruguière.*

LIMA LIMA, *Linn.*, var. MULTICOSTATA, *Sowerby.*

Lima multicostata, Sowerby, Thes. Conch., i., 1843, p. 85, pl. xxii., f. 38.

Stations 48, 49.

Several living specimens from 63-75 fathoms off Port Kembla and off Wollongong in 55-56 fathoms.

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* Dall—Bull. Mus. Comp. Zool., xii., 1885-6, p. 228.

† Tate—Trans. Roy. Soc. S.A., vii., 1885, p. 100, pl. iii., f. 9*a-c*.

‡ Tate—*Op. cit.*, pl. viii., f. 8*a-b*.

LIMA ANGULATA, *Sowerby.*

Lima angulata, Sowerby, Thes. Conch., i., 1843, p. 86, pl. xxii., f. 39, 40.

Stations 13, 49.

A few small valves from off Cape Three Points in 41-50 fathoms, and off Port Kembla in 63-75 fathoms.

LIMA BULLATA, *Born*, sp.

Ostrea bullata, Born, Mus. Caes. Vindob., 1780, p. 110, pl. vi., f. 8.

Stations 13, 49.

A valve from off Cape Three Points in 41-50 fathoms, and off Port Kembla in 63-75 fathoms.

Family MYTILIDÆ.

ARCOPERNA, *Conrad.*

ARCOPERNA RECENS, *Tate.*

Arcoperna recens, Tate, Proc. Malac. Soc., ii., 1897, p. 181, 3 text figures.

Stations 13, 49.

A few fragments of this occurred off Port Kembla in 63-75 fathoms, and off Cape Three Points in 41-50 fathoms.

MODIOLARIA, *Lovén.*

MODIOLARIA BARBATA, *Reeve*, sp.

Lithodomus barbatus, Reeve, Conch. Icon., x., 1858, pl. v., f. 27, and *L. laniger*, f. 30; *Modiolaria barbata*, Angas, Proc. Zool. Soc., 1867, p. 911, pl. 44, f. 12.

Station 28.

A few specimens were obtained off the Manning River in 22 fathoms.

MODIOLA, *Lamarck.*

MODIOLA ARBORESCENS, *Chemnitz*, sp.

Mytilus arborescens, Chemnitz, Conch. Cab., xi., 1795, p. 251, pl. 198, f. 2016-17; *Id.*, Reeve, Conch. Icon., x., 1857, Modiola, pl. vi., sp. 30.

Stations 4, 13, 49.

This world-wide species occurred off Barranjoey in 55-84 fathoms, off Cape Three Points in 41-50 fathoms, and off Port Kembla in 63-75 fathoms.

MODIOLA ALBICOSTA, *Lamarck.*

Modiola albicosta, Lamarck, Anim. s. vert., vi., 1819, pt. 1, p. 111; *Id.*, Delessert, Recueil de Coq., 1841, pl. 13, f. 8*a-b*.

Station 54.

Accepting the usual interpretation of the species, this Tasmanian shell is, by Delessert's figure, associated with Lamarck's name Yet it appears to me as probable that Lamarck applied the name *M. albicosta* to the tropical *M. philippinarum*, Hanley, while he regarded* the Tasmanian shell as a variety of *M. tulipa*.

The following record appears to be the northernmost locality for this species: Jervis Bay, 10-11 fathoms.

MODIOLA AUSTRALIS, *Gray.*

Modiola australis, Gray, King's Survey Intertrop. Coasts Austr., ii., 1827, app. p. 477; *Id.*, Reeve, Conch. Icon., x., Modiola, 1857, pl. v., f. 21.

Station 55.

Gray's brief account is as applicable to *M. albicosta*. Reeve's figure fixes the identity of the species.

Dredged off the Crookhaven River in 11-15 fathoms.

Family MYOCHAMIDÆ.

MYODORA, *Gray.*

MYODORA BREVIS, Stutchbury, sp.

Anatina brevis, Stutchbury, Zool. Journ., v., 1829, p. 99, pl. xliii., f. 1, 2.

Station 49.

One immature valve from 63-75 fathoms off Port Kembla.

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* *Fide* Deshayes—Anim. sans vert., vii., 1836, p. 19, footnote.

Family CUSPIDARIIDÆ.

CUSPIDARIA BRAZIERI, *Smith*, sp.

Neœra brazieri, Smith, Chall. Rep., Zool., xiii., 1885, p. 51, pl. ix., f. 3.

Stations 13, 49.

A few valves from 41-50 fathoms off Cape Three Points, and from 63-75 fathoms off Port Kembla.

CUSPIDARIA LATESULCATA, *Ten. Woods*, sp.

Neœra latesulcata, Ten. Woods, Proc. Linn. Soc. N.S.W., ii., 1877 (1878), p. 123 [not *Neœra (Rhinomya) latesulcata*, Tate, Trans. Roy. Soc. S.A., ix., 1886 (1887), p. 178, pl. xix., f. 7].

Leda, sp. nov., Cox, Proc. Linn. Soc. N.S.W., ii., 1877 (1878), p. 122.

Cuspidaria latesulcata, Hedley, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 20, pl. ii., ff. 11-13.

Station 49.

Since Tenison Woods preoccupied the name chosen by Prof. Tate for a Tertiary species, to avoid confusion I now propose for the latter the name of *Cuspidaria tatei*.

A broken valve comes from off Port Kembla in 63-75 fathoms.

Family CRASSATELLITIDÆ.

CRASSATELLITES, *Kruger*.

CRASSATELLITES SECURIFORME, sp. nov.

(Fig. 53.)

Stations 13, 49.

Shell small, rather flattened, solid, produced, trapezoidal, very inequilateral. Colour yellow-ochre. Sculpture: about eighteen stout, reversely imbricating, concentric ridges traverse the valve,

and are parted by furrows of equal width. Both ridges and furrows are over-run by minute and close concentric threads. Beaks acute and smooth. Inner ventral margin finely denticulate. Length, 6·5; height, 5 mm.

Crassatellites securiforme.
Fig. 53.

There is a group (? *Crassatina**) of small, compressed, ridge sculptured *Crassatellites*, distributed in Australian waters by pairs, one species long, the other short. In Queensland there are *C. torresi*, Smith, and *C. rhomboides*, Smith; in S. Australia, *C. micra*, Verco, *C. producta*, Verco; in New South Wales, *C. securiforme*, Hedley, and *C. scabrilirata*, Hedley. Thanks to the kindness of Dr. J. C. Verco, who forwarded examples of his species, I am enabled to make the following comparisons. In many respects the new species is intermediate between *C. producta*† and *C. micra*;‡ from the former it differs by being shorter in proportion to height, by the ridges being smaller, closer and more numerous, and by the secondary microscopic sculpture being much finer; from *C. micra* it differs by being longer and flatter and by having the interior ventral margin denticulated.§

It has been pointed out by Dr. W. H. Dall‖ that *Crassatella*, Lamarck, 1799, having for type *C. cygnea*, Spengler, is a synonym of *Mactra*. Hence it must be abandoned in favour of *Crassatellites*, Kruger, 1823.¶

A few separate valves were obtained from off Port Kembla in 63-75 fathoms, and off Cape Three Points in 41-50 fathoms.

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* Weinkauff—Conch. Cab., x., Abth. Ia, Crassatella, p. 1, 1881.

† Verco—Trans. Roy. Soc. S.A., xix., 1895, p. 92, pl. i., f. 2.

‡ *Id.*, *op. cit.*, p. 93, pl. i., f. 3.

§ *C. aurora*, Ad. & Ang. (Proc. Zool. Soc., 1863, p. 426, pl. xxxvii., f. 15), from Bass Straits, is a species as yet unrecognised by local workers. I venture to suggest that *C. carnea*, Tate, is probably a synonym of this.

‖ Dall—Trans. Wagner Free Inst., iii., iv., 1898, p. 874.

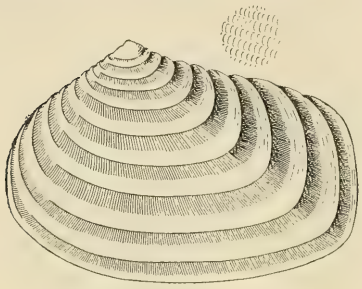
¶ Kruger—Gesch. Urw., ii., 1823, p. 466.

CRASSATELLITES SCABRILIRATA, sp. nov.

(Fig. 54.)

Station 13.

Shell small, rather thin and flattened, rhomboidal, very inequilateral, the posterior side twice the length of the anterior. Colour dull pale yellow. Sculpture about ten low, broad, downwardly curved lamellæ, which are radiately transversed by rows of microscopic scales. Lunule and dorsal area elongate and narrow. Umbo acute. Inner ventral margin smooth. Length, 6·7 ; height, 4·8 mm.



CRASSATELLITES SCABRILIRATA.
Fig. 54.

Its peculiar microscopic sculpture distinguishes this from all southern forms, but connects it with *C. rhomboides*, Smith, a species originally described from Torres Straits, but which I have taken in 15 fathoms off Palm Islands. *C. scabrilirata* is not so abruptly truncated anteriorly, nor so flattened, and has fewer and broader concentric ribs than *C. rhomboides*.

One half-grown valve was taken off Cape Three Points in 41-50 fathoms. I have drawn the figure and description from better material taken off Port Stephens by a Museum dredging excursion.

CUNA, gen. nov.

A genus of the *Crassatellitidæ*. Shell very small, equilateral or slightly rostrate, higher than long, with lunule and impressed dorsal area, beaks erect, prodissoconch marked, valves sometimes clasping. Sculpture radiate or concentric, or both. Inner ventral margin usually denticulate. Hinge plate broad and flat ; in the left valve two well developed cardinals ; in the right a rudimentary cardinal and a massive, projecting, flat-topped and triangular cardinal. Laterals produced, sometimes transversely striated, a posterior and anterior in each valve. Ligament partly internal, protruding in a notch below the beaks.

Type *Cuna concentrica*, Hedley.

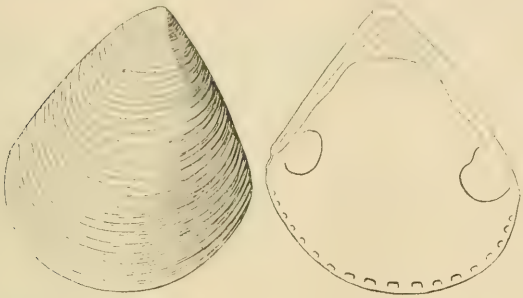
This genus, which embraces *Kellia atkinsoni*, Ten. Woods, *Carditella delta*, Tate and May, &c., has hitherto been confounded with *Carditella*, the hinge structure of which is of a different plan. The erect beak and the fissure above the chondrophore readily distinguish *Cuna* from *Carditella*. The late Prof. Tate told me that species like his *C. delta* occurred fossil in the Australian Tertiary.

CUNA CONCENTRICA, sp. nov.

(Fig. 55.)

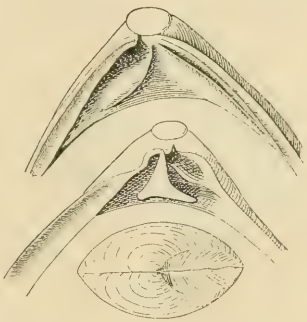
Station 49.

Shell subtrigonal, equilateral, very short, rather flat, glossy,



white. Without radial sculpture, but with about forty concentric ribs of width equal to their interstices. Dorsal margins nearly straight, ventral margin rounded, inner ventral margin set with about twenty square interlocking knobs. Height, 2· mm.; length, 1·85 mm.

Numerous separate and a few conjoined valves from off Port Kembla in 63-75 fathoms.



CUNA CONCENTRICA.
Fig. 55.

CUNA ATKINSONI, *Ten. Woods*, sp.

Kellia atkinsoni, Ten. Woods, Proc. Roy. Soc. Tas. for 1876 (1877), p. 158; *Carditella atkinsoni*, Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 435, pl. xxvii. f. 107.

Station 49.

Three odd valves from off Port Kembla in 63-75 fathoms.

CUNA DELTA, *Tate & May*, sp.

Carditella delta, Tate & May, Trans. Roy. Soc. S.A., xxiv., 1900, p. 102; *Id.*, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 434, pl. xxvii., f. 100, 101; *Id.*, Hedley, Rec. Aust. Mus., iv., 1901, p. 23, f. 5.

Station 13.

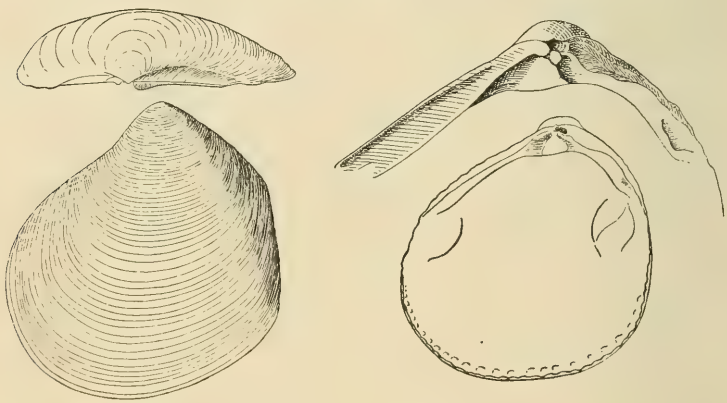
A few immature and separate valves from off Cape Three Points in 41-50 fathoms.

CUNA PARTICULA, sp. nov.

(Fig. 56.)

Stations 13, 49.

Shell small, shallow, oblique, very inequilateral, especially in the younger stage. Colour pale yellow. Anterior margin abruptly



CUNA PARTICULA.
Fig. 56.

truncated. Sculpture: numerous fine, close, concentric threads, becoming coarser and more distant towards the ventral margin. A few opaque radial lines appear in transmitted light, but do not affect the sculpture. Inner ventral margin crenulated by about 16 small interlocking tubercles. Chondrophore less deeply sunk than in the preceding species. Above the cardinal of the left valve are two small semidetached round tubercles. Height, 2 mm.; length, 2·3 mm.

Abundant in 63-75 fathoms off Port Kembla, and in 41-50 fathoms off Cape Three Points.

Family CONDYLOCARDIIDÆ.

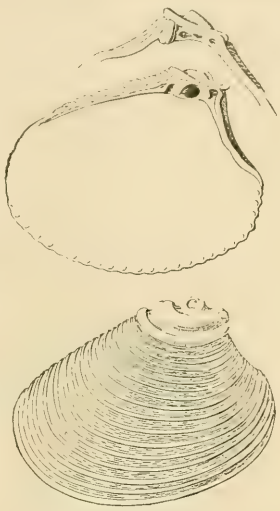
CONDYLOCARDIA, *Bernard.*

CONDYLOCARDIA PROJECTA, sp. nov.

(Fig. 57.)

Stations 13, 49.

Shell extremely small, cream coloured, moderately inflated, ovate cuneate, very inequilateral, the anterior side four times as long as the posterior. Dorsal margin straight, anterior end tapering; ventral margin rounded, posterior end rapidly descending, hollow above, projecting below. Prodissoconch very large, consisting of a medially cleft protuberance, arising from a thick lipped basin, contained in a second basin. Dorsal area lanceolate, hollow, smooth, bounded by a crest whereon terminates the concentric sculpture. Sculpture: there are about sixteen narrow, elevated, curled, reversely imbricating ridges, crowded above, wider spaced below, without trace of radials. Hinge margin long and straight, a line of primitive crenulations above, chondrophore medial well immersed; in the right valve a feeble anterior and posterior cardinal; in the left a single massive posterior cardinal; in each valve an anterior lateral. Muscular impressions invisible. Inner ventral margin with about twenty-five interlocking rounded tubercles. Height, 1 mm.; length, 1·2 mm.



CONDYLOCARDIA PROJECTA.
Fig. 57.

This species is smaller than any Australian bivalve yet described. It represents a genus new to Australian seas. As framed by its author,* *Condylocardia* contains two species from Stewart Island, New Zealand, two from St. Paul's in the Indian Ocean, and a French Tertiary fossil.

A few odd valves were taken by the "Thetis" off Port Kembla in 63-75 fathoms. and off Cape Three Points in 41-50 fathoms. My figures and description are derived from better

* Bernard—Journ. de Conch., xliv., 1896 (1897), p. 169-206.

material taken previously by a Museum dredging excursion at Watson's Bay.

CONDYLOCARDIA PECTINATA, *Tate & May*, sp.

Carditella pectinata, Tate & May, Trans. Roy. Soc. S.A., xxiv., 1900, p. 103 ; *Id.*, Linn. Soc. N.S.W., xxvi., 1901, p. 435, pl. xxvii, ff. 96-97.

Station 49.

A few immature valves from 63-75 fathoms off Port Kembla. The species also occurs in Sydney Harbour.

Family CARDITIDÆ.

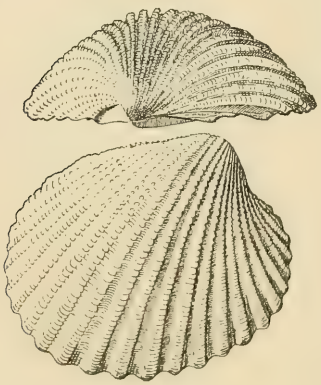
CARDITA, *Bruguière.*

CARDITA CAVATICA, sp. nov.

(Fig. 58.)

Station 49.

Shell inflated, ovate-oblong in the largest specimen, inclining to a square outline when young, very inequilateral, posterior side thrice as long as the anterior. Colour dull cream, sparsely irregularly spotted with chocolate. Sculpture : numerous close, narrow, erect, radiating ribs, 26 in number on the type specimen. These radii are surmounted by scales, about 70 to a rib, which ventrally are low, broad and crowded, while dorsally they gradually become narrow, erect and distant hollow spines. The deep interstices are about the breadth of the radii, and sculptured by concentric threads in broken lengths. Lunule short, cordate and deeply impressed. Inner ventral margin double, developing an interlocking tubercle beneath each furrow of the external sculpture. Length, 17 ; height, 14 ; depth of single valve, 6 mm.



CARDITA CAVITICA.
Fig. 58.

Probably this is the *Cardita*, sp., noted in the Challenger Report as from Port Jackson.* By its remarkable sculpture it

* Smith—Chall. Rep., Zool., xiii., 1885, p. 213.

is allied to a small group of Tertiary *Cardita*, typified by *C. gracilicosta*, T. Woods,* from which it differs by smaller size and greater length in proportion to height.

Numerous separate valves from off Port Kembla in 63-75 fathoms.

CARDITELLA, *Smith.*

CARDITELLA ANGASI, *Smith.*

Cardita angasi, Smith, Chall. Rep., Zool., xiii., 1885, p. 217, pl. xv., f. 9, 9*a*.

Stations 13, 49.

Some specimens, mostly young, from 63-75 fathoms off Port Kembla, and in 41-50 fathoms off Cape Three Points.

Family LUCINIDÆ.

LUCINA, *Bruguière.*

LUCINA BRAZIERI, *Sowerby*, sp.

Tellina brazieri, Sowerby, Proc. Zool. Soc., 1883, p. 31, pl. vii., f. 2 [not *Tellina brazieri*, Sowerby, Conch. Icon., xvii., Tellina, pl. lv., f. 323, 1869.]

? *Lucina fabula*, Reeve, Conch. Icon., vi., Lucina, pl. xi., sp. 69, 1850.

Station 49.

An author's co-type of the second *Tellina brazieri*, Sowerby, received from Mr. J. Brazier, enables me to unravel the vexed synonomy of this species. In the first place, it is a *Lucina*, not a *Tellina;* in the second place, Prof. Tate, to whom I showed the specimen, regarded it as *L. fabula*, Reeve. Prof. Tate is responsible for the introduction of *L. fabula* into Australian lists.† Unless Sowerby's drawing of *L. fabula* is very bad, which is likely enough, the two species, *L. fabula* and *L. brazieri*, are distinct. Further, the existence of *L. fabula* in Australia requires to be proved.

Mr. Brazier suggests to me that this is probably the species listed by Angas‡ as *Semele scabra*, Hanley, which is not otherwise known here.

A few separate valves were taken by the "Thetis" off Port Kembla in 63-75 fathoms.

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* Tate—Trans. Roy. Soc. S.A., vii., 1884 (1885), p. 152.
† Tate—Trans. Roy. Soc. S.A., ix., 1887, p. 96.
‡ Angas—Proc. Zool. Soc., 1877, p. 191.

Family CRYPTODONTIDÆ.

AXINUS, *Sowerby.*

AXINUS FLEXUOSUS, *Montagu*, sp.

Tellina flexuosa, Mont., Test. Brit., 1803, p. 72; *Cryptodon flexuosus*, Brazier, Proc. Linn. Soc. N.S.W., (2), ix., 1894 (1895), p. 725.

Stations 13, 49.

A few separate valves at each locality from off Port Kembla in 63-75 fathoms and off Cape Three Points in 41-50 fathoms.

Family LEPTONIDÆ.

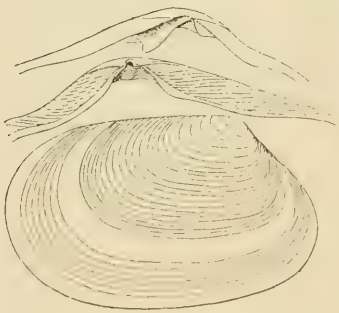
ROCHEFORTIA, *Velain.*

ROCHEFORTIA LACTEA, sp. nov.

(Fig. 59.)

Stations 13, 49.

Shell small, thin, translucent, oblong, moderately inflated, very inequilateral, the anterior being three times the length of the posterior side. Colour milk-white, with translucent zones. Dorsal margin straight, anterior end rounded, ventral margin arcuate, dorsal margin steeply descending, then rounded. Sculpture: fine regular incremental lines. Hinge of right valve with a long strong anterior and a small weak posterior cardinal; left valve notched above the chondrophore. Beaks inconspicuous. Length, 3; height, 1·9 mm.



ROCHEFORTIA LACTEA.
Fig. 59.

Numerous separate valves from off Port Kembla in 63-75 fathoms, and off Cape Three Points in 41-50 fathoms.

ERYCINA, *Lamarck.*

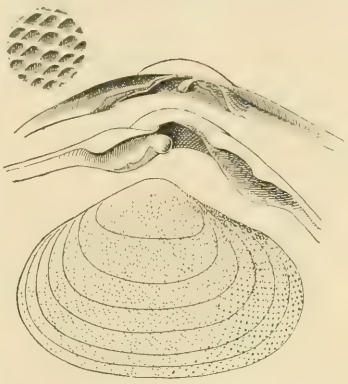
ERYCINA ACUPUNCTA, sp. nov.

(Fig. 60.)

Stations 13, 49.

Shell small, inflated, oblong; dorsal margins straight, ends rounded; ventral margin straight; beaks not prominent; rather solid; milk-white, with translucent zones; the anterior side slightly exceeding the posterior. The whole of the external surface is covered like a thimble with fine punctures, arranged in curved oblique lines of the pattern called "engine turned." In each valve a cardinal, and anterior and posterior lateral. Height, 1·25; length, 2·1 mm.

A few separate valves from off Cape Three Points in 41-50 fathoms, and off Port Kembla in 63-75 fathoms.



ERYCINA ACUPUNCTA.
Fig. 60.

CYAMIUM, *Philippi.*

CYAMIUM MACTROIDES, *Tate & May.*

Cyamium mactroides. Tate & May, Trans. Roy. Soc. S.A., xxiv., 1900, p. 102; *Id.*, Proc. Linn. Soc. N.S.W., xxvi., 1901, pl. xxvii., f. 103.

Station 49.

A few separate valves from off Port Kembla in 63-75 fathoms.

LASÆA, *Leach.*

LASÆA SCALARIS, *Philippi*, sp.

Poronia scalaris, Philippi, Zeit. f. Malak., iv., 1847, p. 72; *Id.*, Angas, Proc. Zool. Soc., 1867, p. 926.

P. parreyssi, Philippi, *op. cit.*, p. 73.

P. purpurata, Philippi, *op. cit.*, p. 73.

P. rugosa, Recluz., Journ. de Conch., iv., 1853, p. 50, pl. ii., f. 4, 5.

P. australis, Souverbie, Journ. de Conch., xi., 1863, p. 287, pl. xii., f. 8; *Id.*, Angas, Proc. Zool. Soc., 1867, p. 926.

Kellia balaustina, Gould, Proc. Bost. Soc. Nat. Hist., viii., 1861, p. 34.

Stations 13, 14.

A few odd valves from off Port Kembla in 63-75 fathoms, and off Cape Three Points in 41-50 fathoms, which were probably swept down from shallow water.

Family CARDIIDÆ.

CARDIUM, *Linne.*

CARDIUM STRIATULUM, *Sowerby*, var. THETIDIS, *Hedley*, var. nov.

Cardium striatulum, Sowerby, Proc. Zool. Soc., 1840, p. 105; *Id.*, Conch. Illust., 1841, Cardium, sp. 9, f. 16 (not 45).

Stations 13, 49.

A considerable series taken by the "Thetis" appears specifically inseparable from *C. striatulum*. Compared with specimens from New Zealand ours are very diminutive, being only 12·5 mm. in length and 11·5 mm. in height; in proportion to their bulk they are more thin and delicate, the concentric sculpture is fainter, and the angle limiting the posterior prickly area is less pronounced.

Sowerby quotes Conch. Ill., f. 45, for his species. It seems to me to represent the allied *C. pulchellum*, Gray.

From off Port Kembla in 63-75 fathoms, and off Cape Three Points in 41-50 fathoms.

Family VENERIDÆ.

CHIONE, *Megerle.*

CHIONE PLACIDA, *Philippi*, sp.

Venus placida, Philippi, Abbild. Beschr., i., 1844, p. 128, pl. ii., f. 2.

V. roborata, Hanley, Proc. Zool. Soc., 1844 (1845), p. 161.

Station 49.

This species is usually quoted by Hanley's name, which, however, is subsequent to that proposed by Philippi. The fascicule

of the Abbildungen containing *V. placida*, is dated April, 1844. That of the Zoological Society's Proceedings containing Hanley's name was issued in February, 1845. It is true that Hanley quotes for his shell "Ind. test. sup., t. 16, f. 25," but at the time he wrote that figure was still unpublished. Hanley afterwards stated* that this plate 16 was issued at the end of 1844.

Numerous specimens from off Port Kembla in 63-75 fathoms, and from off Cape Three Points in 41-50 fathoms.

CHIONE GALLINULA, *Lamarck*, sp.

Venus gallinula, Lamarck, Anim. s. vert., v., 1818, p. 592; *Id.*, Delessert, Recueil., 1841, pl. x., f. 1.

Venus celata, Menke, Spec. Moll. Nov. Holl., 1845, p. 43; *Id.*, Philippi, Abbild. Beschr., ii., 1846, p. 106, pl. v., f. 3.

Station 49.

A few young shells from 63-75 fathoms off Port Kembla.

CHIONE STRIATISSIMA, *Sowerby*, sp.

Erycina cardioides, Lamarck, Anim. s. vert., v., 1818, p. 486; *Id.*, Delessert, Recueil, 1841, pl. iv., f. 7*a-b-c* [not *Venus cardioides*, Lamk., *op. cit.*, p. 590.]

Venus striatissima, Sowerby, Thes. Conch., ii., 1853, p. 718 pl. 157, ff. 103-5.

Station 56.

One valve was taken in 79-80 fathoms off Botany Bay.

MERETRIX, *Lamarck.*

MERETRIX PLANATELLA, *Lamarck*, sp.

Cytherea planatella, Lamarck, Anim. s. vert.. v., 1818, p. 565; *Id.*, Philippi, Abbild. Beschr., i., 1845, p. 199, pl. iii., f. 6.

Cytherea diemenensis, Hanley, Proc. Zool. Soc., 1844, p. 110.

Station 49.

With this species Tate & May have united *M. disrupta*, Sowerby, which I regard as a distinct species.

From off Port Kembla in 63-75 fathoms.

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* Hanley—Recent Shells, 1856, Preface, p. v.

Family PETRICOLIDÆ.

CHORISTODON, *Jonas.*

CHORISTODON RUBIGINOSUM, *Adams & Angas*, sp.

Naranio rubiginosa, Ad. & Ang., Proc. Zool. Soc., 1863, p. 425, pl. 37, f. 17.

Station 56.

One broken valve occurred in 79-80 fathoms off Botany Bay.

Family TELLINIDÆ.

TELLINA, *Linne.*

TELLINA TENUILIRATA, *Sowerby.*

Tellina tenuilirata, Sowerby, Conch. Icon., Tellina, 1867, pl. xxxix., f. 219.

Stations 13, 49.

A few separate valves from off Port Kembla in 63-75 fathoms, and off Cape Three Points in 41-50 fathoms.

Family SAXICAVIDÆ.

SAXICAVA, *Fleuriau de Bellevue.*

SAXICAVA ARCTICA, *Linne*, sp.

Mya arctica, Linn., Syst. Nat., x., 1767, p. 1113.

Stations 13, 49.

A few small valves from off Port Kembla in 63-75 fathoms and off Cape Three Points in 41-50 fathoms.

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AUSTRALIAN MUSEUM, SYDNEY.

MEMOIR IV.

SCIENTIFIC RESULTS

OF THE

TRAWLING EXPEDITION

OF

H.M.C.S. "THETIS"

OFF THE COAST OF NEW SOUTH WALES,

IN

FEBRUARY AND MARCH, 1898.

PART 6.—Published 8th October, 1903.

PUBLISHED BY ORDER OF THE TRUSTEES.

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APR 9 1904

MOLLUSCA.

PART II.

By CHARLES HEDLEY,

Conchologist, Australian Museum.

SCAPHOPODA AND GASTROPODA.

MOLLUSCA.

PART II.

By Charles Hedley.

Conchologist, Australian Museum.

SCAPHOPODA AND GASTROPODA.

(Plates xxxvi., xxxvii., xxxviii.)

SCAPHOPODA.

DENTALIUM, *Linné.*

DENTALIUM THETIDIS, sp. nov.

(Fig. 61.)

Stations 13, 49.

Shell white, rather thin, tapering and very little curved. Sculpture : seven elevated ribs run the whole length of the shell, those on the concave side are stronger and wider apart than the others; each interspace is grooved by a dozen fine even striæ, faintly crossed by growth lines; towards the aperture one or two interstitial riblets arise. Anal orifice simple. Length, 8 mm.; diameter of aperture, 1 mm.

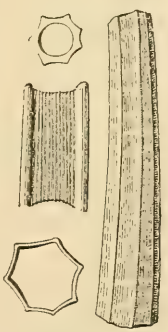

Fig. 61.

This species apparently belongs to the group of *D. octangulatum*, among which the fine dense longitudinal striæ distinguish it.

The example described and two fragments occurred in 63-75 fathoms off Port Kembla. A second specimen occurred in 41-50 fathoms off Cape Three Points.

DENTALIUM LUBRICATUM, *Sowerby.*

Dentalium lubricatum, Sowerby, Thes. Conch., ii., 1860, p. 97, pl. ccv., f. 56.

Stations 13, 49.

Several specimens were obtained from 63-75 fathoms off Port Kembla, of which the largest is 32 mm. long; and from 41-50 fathoms off Cape Three Points.

DENTALIUM VIRGULA, sp. nov.

(Fig. 62.)

Stations 13, 37, 49, 57.

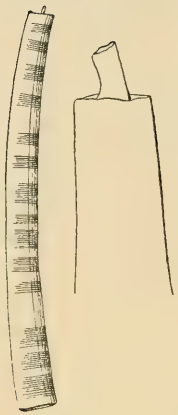

Fig. 62.

Shell small, a little curved, slightly tapering, slender, in section circular, polished, with minute growth rings at irregular intervals, solid at the apex, thin at the aperture; milk-white opaque rings alternate with pale orange translucent ones. Supplementary tube a small round pipe excentric to the direction of the shell and arising in the centre of the apex. Length, 10·5 mm.; breadth at aperture 1·1 mm., at apex 0·62 mm.; diameter of tube, 0·2 mm.

This species belongs to the subgenus *Episiphon* of Pilsbry and Sharp.*

Numerous examples were taken in 63-75 fathoms off Port Kembla; in 41-50 fathoms off Cape Three Points; in 54-59 fathoms off Wata Mooli; and in 50-52 fathoms off Botany Bay.

CADULUS, *Philippi.*

CADULUS SPRETUS, *Tate & May.*

Cadulus spretus, Tate & May, Trans. Roy. Soc. S.A., xxiv., 1900, p. 102; Proc. Linn. Soc. N.S. Wales, 1901, p. 420, pl. xxv., f. 52.

Stations 13, 49, 57.

This species also extends to New Zealand. Mr. A. Hamilton, of Dunedin, has sent me specimens which he dredged in 5 fathoms off Anchor Island, Dusky Sound, N.Z.

* Pilsbry & Sharp—Man. Conch., xvii., 1897, p. 117.

Plentiful at 63-75 fathoms off Port Kembla; 41-50 fathoms off Cape Three Points; and 54-59 fathoms off Wata Mooli.

GASTROPODA.

Order DIOTOCARDIA.

Class ZYGOBRANCHIA.

Family SCISSURELLIDÆ.

SCHISMOPE, *Jeffreys.*

SCHISMOPE ATKINSONI, *Ten. Woods*, sp.

Scissurella atkinsoni, Ten. Woods, Proc. Roy. Soc. Tas., 1876 (1877), p. 149.

Schismope carinata, Watson, Chall. Rep., Zool., xv., 1886, p. 119, pl. viii., f. 6.

Station 49.

Two specimens from 63-75 fathoms off Port Kembla.

SCISSURELLA, *D'Orbigny.*

SCISSURELLA AUSTRALIS, sp.nov.

(Fig. 63.)

Station 49.

Shell large, thin, trochiform, spire gradate, base tumid, narrowly perforate. Colour white. Whorls five. Sculpture: the upper surface of the last whorl has about 64 curved oblique lamellate riblets; on the spire the ribbing is finer and closer and is crossed by fine spiral threads which appear on the lower whorl in broken

lengths. On the base there are about twenty-five coarse, widely spaced radii, most prominent around the umbilicus, which they enter. On the outer circumference of the base are interstitial radii, crossed by half-a-dozen spiral threads. Fasciole enfolded by broad margins. Height, 2·5 mm. ; major diam., 3·0 mm. ; minor diam., 2·5 mm.

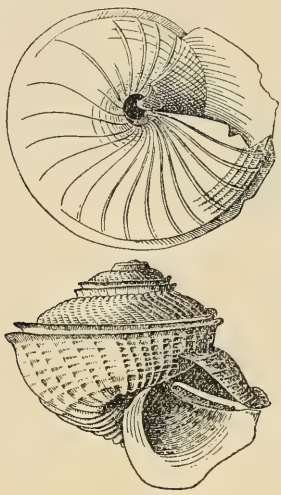

Fig. 63.

The novelty is similar in size, shape and general appearance to *Scissurella æquatoria*, Hedley,* but differs by having the base sculptured by a few distant coarse radii instead of dense fine riblets. The lip of *S. australis* does not project in a lobe over the base like that of *S. æquatoria.*

My material is too scanty to pronounce on the persistence of these features and their systematic value.

In the Australian Museum is an imperfect specimen of a fossil *Scissurella* from Muddy Creek, apparently identical with *S. australis.*

A few imperfect specimens were obtained in 63-75 fathoms off Port Kembla.

Family FISSURELLIDÆ.

PUNCTURELLA, *Lowe.*

PUNCTURELLA HARRISSONI, *Beddome*, sp.

Cemori harrissoni, Beddome, Proc. Roy. Soc. Tas., 1882 (1883), p. 168.

Puncturella henniana, Brazier, Proc. Linn. Soc. N.S. Wales, (2), ix., 1894, p. 177, pl. xiv., f. 14.

Station 13.

One specimen from 41-50 fathoms off Cape Three Points.

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* Hedley—Mem. Aust. Mus., iii., 1899, p. 551, f. 61.

Family COCCULINIDÆ.

COCCULINA, *Dall.*

COCCULINA MERIDIONALIS, sp. nov.

(Fig. 64.)

Station 49.

Shell small, thin, elevated, slightly asymmetrical. Colour white. Apex smooth inrolled, caducous on the largest shell. Summit a little within the posterior margin. Posterior slope steep, a little concave; anterior slope long, arched. Sculpture: fine dense concentric threads. Length, 3·25 mm.; breadth, 2·25 mm.; height, 1·6 mm.

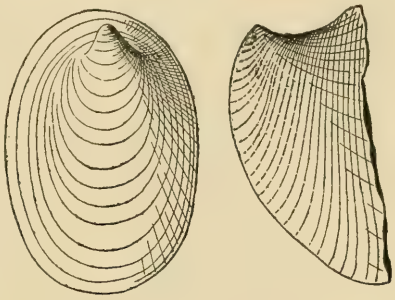

Fig. 64.

Three examples from 63-75 fathoms off Port Kembla.

Class AZYGOBRANCHIA.

Family STOMATELLIDÆ.

GENA, *Gray.*

GENA STRIGOSA, *A. Adams.*

Gena strigosa, A. Adams, Proc. Zool. Soc., 1850, p. 37. *Id.*, Pilsbry, Man. Conch., xii., 1890, p. 39, pl. lv., f. 31, 32, pl. ii., f. 8-16.

Station 55.

A few specimens from 11-16 fathoms off the Crookhaven River.

Family TROCHIDÆ.

MINOLIA, *A. Adams.*

MINOLIA ROSULENTA, *Watson*, sp.

Solarium rosulentum, Watson, Chall. Rep., Zool., xv., 1886, p. 136, pl. viii., f. 12.

Stations 28, 33, 49.

It is a mystery to me why the Rev. B. Watson, who recognised the family likeness of this species, should finally judge it to be a *Solarium*. Sufficient evidence that his decision must be reversed is given by the brilliant iridescence of the aperture, the apex and of any wound in a fresh specimen. It is nearly related to *Minolia pulcherrima*, Angas. Unfortunately the shells before me are empty, so that a further appeal to the soft parts cannot yet be made. Our largest specimen slightly exceeds the type in size, being eight millimetres in broadest diameter.

Three complete specimens and one fragment were taken in 22 fathoms off the Manning River; one specimen occurred in 24-27 fathoms in the north end of the Newcastle Bight; and one in 63-75 fathoms off Port Kembla.

MINOLIA TASMANICA, *Ten. Woods.*

Margarita (Minolia) tasmanica, Ten. Woods, Proc. Roy. Soc. Tas., 1876 (1877), p. 143.

Minolia tasmanica, Pilsbry, Man. Conch., xi., 1889, p. 263, pl. lxix., f. 38, 39, 40.

Stations 28, 33.

My determination of this species is based on comparison with co-types kindly lent me by the Rev. H. D. Atkinson. Tate and May* unite this with *M. vitiliginea*, Menke, but I agree with Pritchard and Gatliff in maintaining it as different.† The keel on the shoulder of the whorl is the only character that separates this from *M. angulata*,, A. Ad.

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* Tate & May—Proc. Linn. Soc. N.S. Wales, xxvi., 1901, p. 404.

† Pritchard & Gatliff—Proc. Roy Soc. Vict., xiv., 1902, p. 133.

From 22 fathoms off the Manning River, and from 24-27 fathoms in the north end of the Newcastle Bight.

MINOLIA BELLULA, *Angas.*

Minolia bellula, Angas, Proc. Zool. Soc., 1869, p. 48, pl. ii., f. 11.

Station 28.

One specimen from 22 fathoms off the Manning River.

MINOLIA ARATA, sp. nov.

(Fig. 65.)

Stations 37, 44.

Shell turbinate, widely umbilicate, rather thin. Colour pale yellow, with purple disposed in dots on the shoulder and stripes on the base. Whorls five, tabulate above, angled at the shoulder, thence rounded, last in slight contact with its predecessor; sutures impressed. Sculpture: the flat sutural shelf of the upper whorls is ornamented by fine regular radial riblets; obliquely descending the slope these riblets crenulate the upper spirals and gradually vanish on the last whorl into faint irregularly spaced growth lines. On the upper whorls are five spiral cords, between which are smaller threads, in their turn separating still finer lines. The last whorl is encircled by ten strong keels whose interstices are occupied by small and smaller threads as before. Apex elevated, of two whorls small and glossy. Umbilicus wide and deep, penetrated by five elevated spiral ridges beaded by longitudinal sculpture. Aperture circular, slightly oblique, peristome entire, simple, sharp, within brilliantly nacreous, nacre edged with a thin brown and a broader yellow non-nacreous margin. Major diam., 9·5; minor diam., 7·5; height, 7 mm.

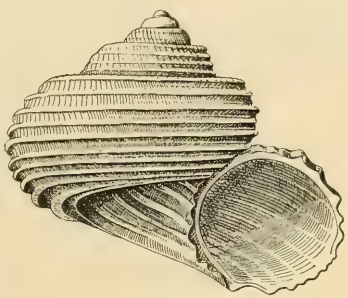

Fig. 65.

This species is allied to *M. pulcherrima*, Angas, and *M. rosulenta*, Watson, than which it is of duller hue and of weaker radial sculpture.

Another member of this genus which I have lately been able to add to the fauna of New South Wales is *M. phillipensis*, Watson,* taken in 100 fathoms, 16 miles east of Wollongong.

Taken by the "Thetis" in 50-52 fathoms off Botany Bay, in 49-50 fathoms off Coogee, and recently by Mr. G. H. Halligan and myself in 100 fathoms, sixteen miles east of Wollongong. On the "Challenger" dredging entertainment of 3rd June, 1874, Mr. J. Brazier obtained a young specimen from 45 fathoms, five miles east of Sydney Heads.

GIBBULA, *Risso.*

GIBBULA TASMANICA, *Petterd.*

Gibbula tasmanica, Petterd, Journ. Conch., ii., 1879, p. 103. *Id.*, Pilsbry, Man. Conch., xi., 1889, p. 237, pl. xl., f. 20.

Station 49.

One dead shell in 63-75 fathoms off Port Kembla.

GIBBULA STRANGEI, *A. Adams.*

Gibbula strangei, A. Adams, Proc. Zool. Soc., 1867, p. 217. *Id.* Pilsbry, Man. Conch., xi., 1889, p. 231, pl. xxxii., f. 61, 62.

Station 65.

One living specimen from 11-16 fathoms off Crookhaven River.

CANTHARIDUS, *Montfort.*

CANTHARIDUS FASCIATUS, *Menke*, sp.

Phasianella fasciata, Menke, Synop. Meth. Moll., 1830, p. 141.

Cantharidus fasciatus, Pilsbry, Man. Conch., xi., 1889, p. 139, pl. xl., f. 28-33.

? *Bankivia lugubris*, Gould, Proc. Boston Soc. Nat. Hist., viii., 1861, p. 18.

Stations 27, 33, 49.

A dead shell from 22 fathoms off Manning River and another from 24-27 fathoms in the north end of the Newcastle Bight; a third from 63-75 fathoms off Port Kembla.

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* *Trochus (Solariella) philippensis*, Watson—Chall. Rep., Zool., xv., 1886, p. 73, pl. vi., f. 10.

CANTHARIDUS PICTURATUS, *H. & A. Ad.*, sp.

Leiopyrga picturata, H. & A. Ad., Ann. Mag. Nat. Hist., 1863, p. 19.

Cantharidus picturata, Pilsbry, Man. Conch., xi., 1889, p. 140, pl. xlv., f. 46, 48.

Station 33.

A dead shell from 24-27 fathoms in the north end of the Newcastle Bight.

CANTHARIDUS DECORATUS, *Philippi*, sp.

Trochus decoratus, Phil., Zeitsch. Mal., 1846, p. 102.

Cantharidus decoratus, Hedley, Proc. Linn. Soc. N.S. Wales, xxvi., 1901, p. 19.

Station 55.

One specimen from 11-16 fathoms off the Crookhaven River.

Family TURBINIDÆ.

CALCAR, *Montfort.*

CALCAR FIMBRIATUM, *Lamarck*, sp.

Trochus fimbriatus, Lamarck, Hist. Nat. Anim. s. vert., vii., 1822, p. 12.

Astralium fimbriatum, Kesteven, Proc. Linn. Soc. N.S. Wales, xxvii., 1902, p. 2, f. 1.

Station 49.

The genus *Calcar* is better known by the name of *Astralium*, Link. Concerning the memoir in which Link's description was contained, Mörch writes: "Of this work, which appeared as a University program, only a few copies comparatively were distributed, the greater number having been preserved in the stores of the University."*

It is obvious that *Astralium*, Link, cannot honestly be said to have been published in 1807. Probably as a published name *Astralium* should date from Hermannsen's article in the Proceedings of the Zoological Society of London for 1851, p. 231.

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* Mörch—Proc. Zool. Soc., 1862, p. 226.

Unless the rules of zoological nomenclature are to be broken, *Calcar* must be used instead of *Astralium*.

Two immature shells from 63-75 fathoms off Port Kembla.

Family LIOTIIDÆ.

LIOTIA, *Gray*.

LIOTIA ANNULATA, *Ten. Woods*.

Liotia annulata, Ten. Woods, Proc. Roy. Soc. Tas., 1877 (1878), p. 121. *Id.* Tryon, Man. Conch., x., 1888, p. 111, pl. xxxvi., f. 20. *Id.* Tate, Trans. Roy. Soc. S.A., xxiii., 1899, p. 225. *Id.* Tate & May, Proc. Linn. Soc. N.S. Wales, xxvi., 1901, pp. 398, 460.

Stations 13, 49.

Two examples were taken by the "Thetis" in 63-75 fathoms off Port Kembla, another in 41-50 fathoms off Cape Three Points; it was also dredged in 100 fathoms off Wollongong by Mr. G. H. Halligan and myself.

LIOTIA TASMANICA, *T. Woods*, var. SCALARIS, var.nov.

Liotia tasmanica, Ten. Woods, Proc. Roy. Soc. Tas., 1875 (1876), p. 153. *Id.* Hedley, Proc. Linn. Soc. N.S. Wales, (2), ix., 1895, p. 465, figs.

Station 55.

Northern examples differ from the typical southern forms by being elevated and scalariform, with a narrower umbilicus. This variation I propose to distinguish as var. *scalaris*. In deep water individuals, as usual, the sculpture is sharper and more prickly than in shallow water shells.

One example was taken by the "Thetis" from 11-15 fathoms off the Crookhaven River. Also dredged by Mr. G. H. Halligan and myself in 100 fathoms, 16 miles east of Wollongong.

LIOTIA DISJUNCTA, sp. nov.

(Fig. 66.)

Station 13.

Shell small, turbinate, broadly umbilicate. Colour pale brown. Whorls three, of which the first one and a half are embryonic; last whorl rapidly increasing and descending, at last becoming loose, angled at the periphery, at the base and at the umbilical margin. Sculpture: above are numerous closely packed strong

radial ribs, which project as denticules from the periphery. Between the basal and peripheral angles the ribs descend perpendicularly and are crossed by fine spiral threads. Crossing the base the ribs ascend the umbilicus. Aperture simple, oblique, circular. Height, 1·1 mm.; maj. diam., 1·5 mm.; minor diam., 1·1 mm.

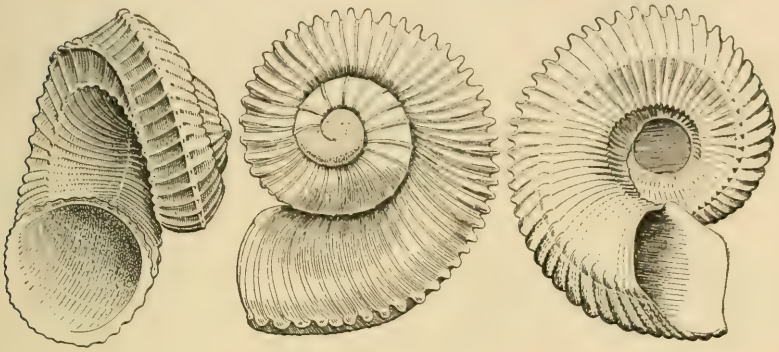

Fig. 66.

The minute size, simple aperture and uncoiling of the last whorl distinguish this species.

A whole shell and a fragment occurred in 41-50 fathoms off Cape Three Points.

LIOTIA MICANS, *A. Ad.*, var. ANGASI, *Crosse.*

Cyclostrema micans, A. Ad., Proc. Zool. Soc., 1850, p. 44. *Id.* Tate, Proc. Roy. Soc. S.A., xxi., 1897, p. 44.

Liotia angasi, Crosse, Journ. de Conch., xii., 1864, p. 343, pl. xiii., f. 4.

Station 28.

One specimen from 22 fathoms off the Manning River.

Family CYCLOSTREMATIDÆ.

CYCLOSTREMA, *Marryatt.*

CYCLOSTREMA INSCRIPTUM, *Tate.*

Cyclostrema inscriptum, Tate, Trans. Roy. Soc. S.A., xxiii., 1899, p. 216, pl. vii., f. 3 *a*, *b*.

(Fig. 67.)

Stations 13, 49.

This species is not determined with certainty, for I have no good specimens for comparison, and the measurements do not

precisely agree. The example drawn is 1·9 mm. in major diameter, 1·5 mm. in minor diameter, and 0·9 mm. in height.

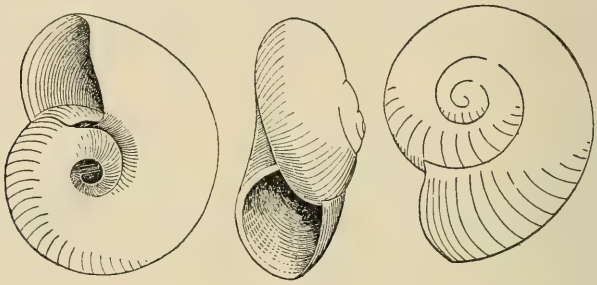

Fig. 67.

Several examples from 41-50 fathoms off Cape Three Points, and from 63-75 fathoms off Port Kembla.

CYCLOSTREMA ANGELI, *Ten. Woods*, var. CREBRESCULPTUM, *Tate.*

Cyclostrema crebresculptum, Tate, Trans. Roy. Soc. S.A., xxiii., 1899, p. 219, pl. vii., f. 5.

Stations 13, 49.

A few examples from 41-50 fathoms off Cape Three Points, and from 63-75 fathoms off Port Kembla.

CYCLOSTREMA PORCELLANUM, *Tate & May.*

Cyclostrema porcellanum, Tate & May, Trans. Roy. Soc. S.A., xxiv., 1900, p. 101. *Id.*, Proc. Linn. Soc. N.S. Wales, xxvi., 1901, p. 397, pl. xxvii., f. 93.

Station 13.

Numerous specimens from 41-50 fathoms off Cape Three Points.

CYCLOSTREMA JOHNSTONI, *Beddome.*

Cyclostrema johnstoni, Beddome, Proc. Roy. Soc. Tas., 1882 (1883), p. 148. *Id.* Tate, Trans. Roy. Soc. S.A., xxiii., 1899, p. 215, pl. vii., f. 7*a*, *b*.

Station 49.

Two specimens from 63-75 fathoms off Port Kembla.

Order MONOTOCARDIA.

Class TÆNIOGLOSSA.

Family LOTORIIDÆ.

LOTORIUM, *Montfort.*

LOTORIUM PUMILIO, sp.nov.

(Fig. 68.)

Station 28.

Shell ovate conic, small, thin, smooth and glossy. Colour reddish-yellow, with occasional chocolate spots, aperture pale yellow. Whorls five, plus a two-whorled protoconch. Sculpture: varices eight; fine close longitudinal plications occur on the uppermost whorls, which as the shell increases become more widely spaced and less pronounced, finally on the penultimate and last whorl they degenerate into a row of peripheral nodules, which are absent from the ventral side of the body whorl; spiral ornament consisting of fine close flat-topped riblets, on the last whorl 40, on the penultimate 20, varying in size, separated by narrow interstices; the growth lines are nearly obliterated from the riblets but persist in the interstices as microscopic scales. Protoconch low, turbinate, two-whorled, furrowed by two spiral incised lines, one on the shoulder, the other on the periphery. Suture distinct waved by the varices and longitudinal plications. Epidermis thin, closely adherent, without frills or tags. Outer lip sharp, a little expanded, very faintly dentate, not lirate within. Inner lip with a sharply defined rather thick callus; in the hollow of the columella are a few indistinct ridges, and an obscure tubercle appears in the posterior angle. Canal short, open, recurved. Length, 16; breadth, 8·5 mm.

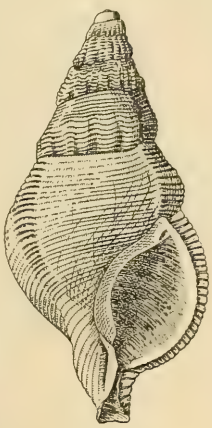

Fig. 68.

This species appears to be the smallest of the genus. The nearest relation is *L. bassi*, Angas, with which it agrees in the small number of whorls, colour, sculpture and general appearance,

but from which it is easily distinguished by the slender form, small size and absence of liræ within the lip. Tryon* follows Schmeltz† in regarding *Triton fraterculus*, Dunker,‡ as a synonym of *T. bassi*, Angas, but it seems to me that the description of *T. granulatum*, Dunker, suits *T. bassi* better than does that of *T. fraterculus*. A recent addition to the Lotoriidæ of New South Wales is *L. nodocostata*, Tate & May, which I dredged in 100 fathoms sixteen miles east of Wollongong.

A single living specimen was dredged in 22 fathoms off the Manning River.

LOTORIUM PARKINSONIANUM, *Perry*, emend. sp.

Septa parkinsonia, Perry, Conchology, 1811, pl. xiv., f. 1.
Triton fusiformis, Kiener, Coquilles Vivantes, 1842, p. 36, pl. v. fig. 2.

Stations 13, 49.

A few apices of this species were procured in 41-50 fathoms off Cape Three Points, and in 63-75 fathoms off Port Kembla.

Family CASSIDIDÆ.

CASSIDEA, *Bruguiere.*

The generic name *Cassidea*, proposed by Bruguiere,§ and supported by Perry and Swainson, has been generally overlooked, but it is certainly entitled to precedence over *Semicassis*, which if cited as of Klein must be rejected as prelinnean, but if as of Mörch, is more than half a century younger.

CASSIDEA TURGIDA, *Reeve*, sp.

Cassis turgida, Reeve, Conch. Icon., v., 1848, Cassis, pl. x., f. 25.

(Plate xxxvi., fig. 1.)

Stations 48, 56.

The "Thetis" took a large shell 100 mm. in length, thin, with rounded whorls and brown zigzag markings on a white ground. It is with diffidence that I record it under the above name, as it lacks the denticules on the lip and exceeds Reeve's figure in size.

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* Tryon—Man. Conch., iii., 1881, p. 11.
† Schmeltz—Cat. Mus. Godeff., iv., 1874, p. 107.
‡ Dunker—Malak. Blatt., 1871, p. 166.
§ Bruguiere—Encyl. Meth., Vers., i., 1792, p. 414.

In dealing with such protean forms as the members of this genus, it seems preferable to allow considerable latitude for variation than to erect a new species upon scanty material.

From 55-56 fathoms off Wollongong, and 79-80 fathoms off Botany Bay; one specimen from each locality.

CASSIDEA RECURVIROSTRUM, *Gmelin*, sp.

Buccinum recurvirostrum, Gmelin, Syst. Nat., xiii., 1790, p. 3477.

Cassis recurvirostrum, Reeve, Conch. Icon., v., 1848, Cassis, pl. vii., f. 16.

Station 13.

Gmelin's name was founded on a drawing by Lister of a shell from Barbadoes. It is improbable that Reeve correctly identified this with an Australian species. Means are wanting to disentangle the complicated history of the species, and it suffices to say that the one figured by Reeve is that before me.

From 41-50 fathoms off Cape Three Points.

CASSIDEA PYRUM, *Lamarck*, var. THOMSONI, *Brazier*.

Cassis thomsoni, Brazier, Proc. Linn. Soc. N.S. Wales, i., 1875, p. 8.

(Plate xxxv., figs. 2, 3.)

Station 13.

Brazier's type of this species is in the Australian Museum. It differs from *C. pyrum* var. *paucirugis*, Menke, by the multiplication of the grains on the shoulder.

From 41-50 fathoms off Cape Three Points; one specimen.

Family DOLIIDÆ.

DOLIUM, *Lamarck*.

DOLIUM VARIEGATUM, *Lamarck*.

Dolium variegatum, Lamarck, Hist. Nat. Anim. s. vert., vii., 1822, p. 261. *Id.* Tryon, Man. Conch., vii., 1885, p. 262, pl. iii., f. 13, 14.

Stations 35, 41, 46.

A few specimens from 22-38 fathoms off Port Hacking, 52-71 fathoms off Wata Mooli, 50-66 fathoms off Jibbon.

Family AMPHIPERASIDÆ.

PEDICULARIA, *Swainson.*

PEDICULARIA STYLASTERIS, sp. nov.

(Figs. 69, 70.)

Stations 44, 48.

Shell variable in shape, according to the irregularity of the perch. Colour rose-pink. Sculpture: on the earlier convolute whorls are fine spiral threads obliquely cut by growth lines, upon the compressed sides are coarser and more distant spiral threads. The apex is conical, five-whorled, with the usual cancellate sculpture, completely buried in the adult shell. Aperture roughly

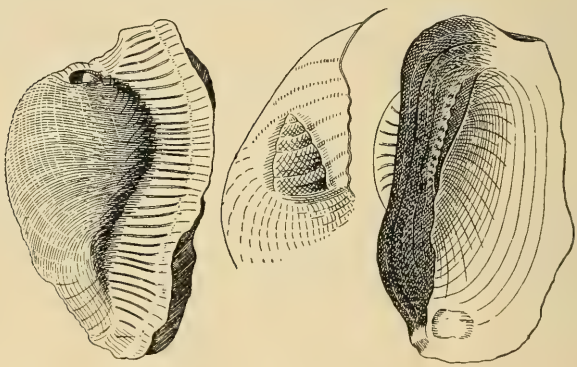

Fig. 69.

oblong, irregularly lobed, with an anterior and posterior canal more or less developed. Columella expanded, longitudinally ribbed, anteriorly with a deep set line of denticles; just within the anterior margin is a muscle scar. Length of aperture, 6 mm., breadth, 3 mm.; height from back to base, 4 mm.

This shell, representing a genus new to Australia, occurred on branches of *Stylaster sanguineus*, Val. (fig. 70), obtained off Wollongong at a depth of 55-66 fathoms, and again off Coogee in 49-50 fathoms. Mr. H. Mort has shown me a specimen he collected on the beach at Long Bay, near Sydney. The removal of a *Pedicularia* from a branch of *Stylaster* exposes a shallow

excavation. This scar is probably owing rather to arrested development at a point surrounded by normal growth, than to the actual removal of matter.

In an erratic group like these commensals, it is difficult to seize on features of specific discrimination. Judging from literature, *P. stylasteris* appears to differ by its denticulate columella and buried apex from others of the genus; some weight may attach to the difference of the host.

Fig. 70.

The host lends its colour to the commensal, and there is a probability that different *Pedicularia* may be confined to different hosts. *P. sicula*, Swainson, is said by Philippi* to be attached to *Corallium rubrum*. *P. japonica*, Dall., occurs on *Gorgonia*.† According to the same author,‡ *P. decussata*, Gould, lives on *Madrepora*, as does an unnamed species figured by Dr. J. D. Macdonald.§ Mrs. J.G. Waterhouse, of Sydney, has shown me examples of *P. pacifica*, Pease, from Niue, Central Pacific, attached to *Distichopora coccinea*, Gray, a host already named by Schmeltz.‖

Family STRUTHIOLARIIDÆ.

STRUTHIOLARIA, *Lamarck.*

STRUTHIOLARIA SCUTULATA, *Martyn*, sp.

Buccinum scutulatum, Martyn, Univ. Conch., i., 1789, pl. 55.

Struthiolaria scutulata, Tryon, Man. Conch., vii., 1885, p. 134, pl. xii., f. 39, 40.

Stations 28, 52.

This species is the type of the genus *Tylospira*,¶ a division which appears to me hardly worth subgeneric rank.

One specimen from 19-20 fathoms in the Shoalhaven Bight; another from 22 fathoms off the Manning River.

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* Philippi—Moll. Sicil., i., 1844, p. 92.
† Dall.—Am. Journ. Conch., vii., 1871, p. 122.
‡ Dall.—Bull. Mus. Comp. Zool., xviii., 1889, p. 238.
§ Macdonald—Trans. Linn. Soc., xxii., 1856, p. 243.
‖ Schmeltz—Cat. Mus. Godeff., iv., 1874, p. 141.
¶ Harris—Brit. Mus. Cat. Tert. Moll. Austr., 1897, p. 222.

ZEMIRA, *H. & A. Adams.*

ZEMIRA AUSTRALIS, *Sowerby*, sp.

Eburna australis, Sowb., Conch. Illustr., 1841, Eburna, f. 5.

Stations 28, 33

I have already discussed the systematic position of the species and concluded that it would be naturally placed in the *Struthiolariidæ*.* This view was subsequently endorsed by Prof. Tate.

One specimen from 1-3 fathoms in the Newcastle Bight; another from 22 fathoms off the Manning River.

Family TRICHOTROPIDÆ.

LIPPISTES, *Montfort.*

LIPPISTES TORCULARIS, *Ten. Woods*, sp.

Cingulina torcularis, Ten. Woods, Proc. Linn. Soc. N.S. Wales, ii., 1878, p. 263.

Trichotropis torcularis, Hedley, Rec. Austr. Mus., iv., 1, 1901, p. 22, f. 2.

Lippistes torcularis, Hedley, Proc. Linn. Soc. N.S. Wales, xxvii., 1902, p. 24.

Stations 13, 28.

One example from 41-50 fathoms off Cape Three Points, and another from 22 fathoms off the Manning River.

SIRIUS, *Hedley.*

SIRIUS BADIUS, *Ten. Woods*, sp.

Raulinia badia, Ten. Woods, Proc. Linn. Soc. N.S. Wales, ii., 1878, p. 264.

Sirius badius, Hedley, Proc. Linn. Soc. N.S. Wales, xxv., 1900, p. 88, pl. iii, f. 8.

Station 37.

The genus is allied to *Lippistes*, but differs by the projection on the columella and by a different protoconch.

Two specimens from 50-52 fathoms off Botany Bay.

*Hedley—Rec. Austr. Mus., iii., 5, 1899, p. 118.

CROSSEA, *A. Adams.*

CROSSEA CARINATA, sp. nov

(Fig. 71.)

Station 49.

Shell minute, smooth and glossy, turbinate. Colour cream. Whorls four, parted by impressed sutures, last bluntly keeled at the periphery. Sculpture: dense spiral microscopic striæ. Base rounded. Umbilicus narrow and deep, surrounded by a callus funicle which expands anteriorly to join the lip in an angular lobe. Aperture subcircular, lip simple. Height, 1·7 mm.; major diam., 1·8 mm.; minor diam., 1·46 mm.

Fig. 71.

Two specimens off Port Kembla in 63-75 fathoms. Also taken by Mr. G. H. Halligan and myself in 100 fathoms sixteen miles east of Wollongong.

Family CERITHIIDÆ.

BATILLARIA, *Benson.*

BATILLARIA AUSTRALIS, *Quoy & Gaim.*, sp.

Cerithium australe, Quoy & Gaimard, Voy. Astrolabe, Zool., iii., 1834, p. 131, pl. lv., f. 7.

Station 27.

Two dead shells from 22 fathoms off the Manning River.

BITTIUM, *Gray.*

BITTIUM GRANARIUM, *Kiener*, sp.

Cerithium granarium, Kiener, Coquilles Vivantes, v., 1842, p. 72, pl. xix., f. 3.

Cerithium lacertinum, Gould, Proc. Boston Soc. Nat. Hist., vii., 1861, p. 386. *Id.*, Sowerby, Conch. Icon., Cerithium, 1865, pl. xviii., f. 129.

Stations 27, 55.

From 22 fathoms off the Manning River, and from 11-15 fathoms off the Crookhaven River.

ATAXOCERITHIUM, *Tate.*

ATAXOCERITHIUM SEROTINUM, *A. Ad.*, sp.

Cerithium serotina, A. Ad., Thes. Conch., ii., 1855, p. 861, pl. clxxx., f. 102.

Cerithium tubulus, Dunker, Mal. Blatt., xviii., 1871, p. 152.

Station 36.

One specimen from 20-23 fathoms off Botany Bay.

Family TRIPHORIDÆ.

TRIPHORA, *Blainville.*

TRIPHORA TASMANICA, *Ten. Woods.*

Triforis tasmanica. Ten. Woods, Proc. Roy. Soc. Tas., 1875 (1876), p. 28. *Id.*, Tate & May, Proc. Linn. Soc. N.S. Wales, xxvi., 1901, p. 388, f. 7.

Triphora tasmanica, Hedley, Proc. Linn. Soc. N.S. Wales, xxviii., 1903, p. 612, pl. xxxii., fig. 22.

Stations 13, 48.

One specimen from 55-56 fathoms off Wollongong; another from 41-50 fathoms off Cape Three Points.

Family VERMETIDÆ.

VERMETUS, *Mörch.*

VERMETUS WAITEI, sp. nov.

(Fig. 72.)

Station 49.

Shell small, solitary. Whorls four, first three prostrate, coiled in one plane, adherent to each other and their common base, last

free, spiral, suberect. Colour white. Penultimate whorl square in section, along each angle runs a sharp elevated rib, towards the aperture these ribs converge together on the superior side and frequently continue as sharp lamellæ to the aperture. Between the ribs the surface is sculptured by crescentic growth striæ. Aperture circular, expanded, trumpet-mouthed, slightly notched above the spiral ribs; sometimes two or three former apertures persist as variceal rings on the last whorl. Length of shell, about 3·25 mm.

Fig. 72.

This species, whose exact generic position requires to be verified, is named in honour of my colleague Mr. E. R. Waite, who obtained the collection here described.

Several specimens adherent to larger shells were taken in 63-75 fathoms off Port Kembla.

Family TURRITELLIDÆ.

TURRITELLA, *Lamarck.*

TURRITELLA SUBSQUAMOSA, *Dunker.*

Turritella subsquamosa, Dunker, Mal. Blatt., xviii., 1871, p. 152.

Turritella acuta, Ten. Woods, Proc. Roy. Soc. Tas., 1875 (1876), p. 143 [not *P. acuta*, M. C. Mayer, Journ. de Conch., vii., 1859, p. 298, pl. xi., f. 7].

Turritella oxyacris, Tate *(nom. mut.)*, Trans. Roy. Soc. S.A., xxi., 1897, p. 41.

Turritella lamellosa, Watson, Chall. Rep., Zool., xv., 1886, p. 474, pl. xxix., f. 6.

Stations 13, 37, 49.

Dunker's name, which certainly refers to this species, has not been previously recognised in Australia. Schmeltz erroneously reduces it to a synonym of *Torcula declivis*, Ad. & Reeve.* The shell appears to be common and widely distributed on our continental shelf.

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* Schmeltz—Cat. Mus. Godeff., v., 1874, p. 107.

The "Thetis" took it off Cape Three Points in 41-50 fathoms, off Botany Bay in 50-52 fathoms, and off Port Kembla in 63-75 fathoms. It was dredged by a Museum expedition in 1880 in 35 fathoms off Broughton Island, Port Stephens, and this year by myself in 100 fathoms sixteen miles east of Wollongong.

TURRITELLA PHILLIPENSIS, *Watson*, emend.

Turritella philippensis, Watson, Chall. Rep., Zool., xv., 1886, p. 479, pl. xxx., f. 1.

Stations 13, 32.

A few young shells from each locality are thus doubtfully determined. The habitat of the type is written by Watson "Port Philip, South Australia," meaning, of course, Port Phillip, Victoria. The error is repeated in the derived specific name, which I now correct.

Off Cape Three Points, 41-50 fathoms, and off Cape Hawke, 10-12 fathoms.

TURRITELLA SINUATA, *Reeve*.

Turritella sinuata, Reeve, Conch. Icon., v., Turritella, 1849, pl. xi., f. 62.

Stations 28, 33, 49.

In 22 fathoms off the Manning River, in 24-27 fathoms in the north end of the Newcastle Bight, and in 63-75 fathoms off Port Kembla.

TURRITELLA SOPHIÆ, *Brazier*.

Turritella incisa, Ten. Woods, Proc. Linn. Soc. N.S. Wales, ii., 1878, p. 262 [not *T. incisa*, Reeve, Conch. Icon., v., Turritella, 1849, pl. xi., f. 63].

T. sophiæ, Brazier (*nom. mut.*), Proc. Linn. Soc. N.S. Wales, viii., 1883, p. 227.

Station 28.

The type of this species is preserved in the Australian Museum, but appears to have suffered a fracture of the lip, losing thereby the peculiar sinus, which is yet indicated by the curved growth lines behind the lip. The "Thetis" procured a second specimen, of a deep claret colour, 12 mm. long, from which one or more basal whorls have been broken away. This imperfect material is insufficient for the desired comparison with *T. occisa*, Watson.

Reeve's *T. incisa*, reported as taken by Strange in deep water outside Sydney, has not been found again.

Off the Manning River in 22 fathoms.

TURRITELLA PARVA, *Angas*, sp.

Torcula parva, Angas, Proc. Zool. Soc., 1877, p. 174, pl. xxvi., f. 17.

Stations 37, 49.

A few specimens were taken off Port Kembla in 63-75 fathoms and one from 50-52 fathoms off Botany Bay. Two examples were received in 1880 from 35 fathoms off Port Stephens.

While on the subject of *Turritella*, I may mention in reference to Miss Donald's recent paper* that *Turritella smithiana*, Donald, and *T. crenulata*, Donald, described as from the neighbourhood of Sydney, are not Australian, but probably Atlantic forms. *T. godeffroyana*, Donald, is *T. tasmanica*, Ten. Woods, non Reeve, and *T. atkinsoni*, Tate & May; over the latter Miss Donald's name has four months' priority. If I have understood that species, *T. quadrata*, Donald, is the common Tasmanian form, which I have not seen from the coast of New South Wales; while *T. sinuata*, Reeve, is the common form in New South Wales, and does not extend to Tasmania.

Family SOLARIIDÆ.

SOLARIUM, *Lamarck.*

SOLARIUM MAXIMUM, *Philippi.*

Solarium maximum, Philippi, Zeitsch. f. Malak., 1848, p. 173.
Id., Conch. Cab., Bd. ii., Abth. 8, Solarium, 1853, p. 6, pl. 1, f. 2, 3.

Stations 13, 28, 49.

(Fig. 73.)

This is the species locally recorded† as *Solarium lævigatum*, Lamarck. Pelseneer‡ investigated Gould's genus *Agadina* and showed that though the original species was probably founded on the Pteropod *Limacina antarctica*, S. P. Woodward, the other species so unhappily added by H. & A. Adams are larval Gasteropoda, and concludes:—"But to what streptoneural

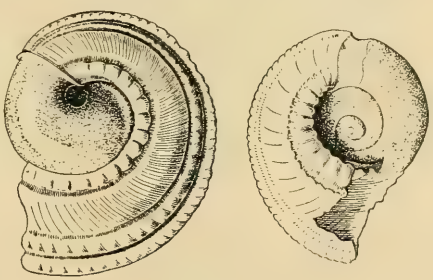

Fig. 73.

* Donald—Proc. Mal. Soc., iv., 1900, pp. 47-55, pl. v.
† Whitelegge—Pro. Roy. Soc. N.S. Wales, xxiii., 1889, p. 260.
‡ Pelseneer—Chall. Rep., Zool., xxiii., 1888, p. 37.

Gasteropods do these larval "*Agadina*" forms belong? The marine left-handed Gasteropods are not, indeed, very numerous. But it must be remembered that some Gasteropods, with right-handed spirals, have their initial portion or nucleus twisted to the left. This is not improbably the case with the larval forms in question, for the left-handed twisting of the operculum in all likelihood corresponds to the right-handed twisting of the shell."

A series of *Solarium* showing the early stages, included in the "Thetis" collection, has provided the solution of Pelseneer's problem.

The protoconch of *S. maximum* is white, smooth, sinistral, turbinate, three-whorled, whorls slightly elevated, narrowly umbilicated, with circular, expanded and reflected aperture. With sudden change in colour, texture and sculpture, the adult shell is built on the expanded lip. The protoconch is completely inverted with regard to the adult, so that the larval umbilicus is at the summit of the full grown shell, and the spire of the embryo forms the centre of the umbilicus of the adult. The diameter of the protoconch is about 1·5 mm.

My drawings show the basal aspect of a shell with half an adult whorl, the umbilicus of which is forming round the embryonic apex; also a slightly older shell viewed from above.

Stripped of the adult shell, this protoconch conforms to the figures and description given by Pelseneer of his "*Agadina*, n.sp."

The larval shell of *Solarium* appears to have been discovered by Dr. Jousseaume, who described it at a meeting of the Société Zoologique de France.* For this type of apex Dautzenberg and Fischer have proposed the term "anastrophic."†

A few specimens were taken off Port Kembla in 63-75 fathoms, off Cape Three Points in 41-50 fathoms, and off the Manning River in 22 fathoms.

SOLARIUM STRAMINEUM, *Gmelin*, sp.

Trochus stramineus, Gmelin, Syst. Nat. xiii., 1790, p. 3575.

Solarium stramineum, Hanley, Thes. Conch., iii., 1863, p. 242, pl. v., f. 95, 96, 97.

Stations 37, 49.

A few young shells were taken off Port Kembla in 63-75 fathoms, and off Botany Bay in 50-52 fathoms.

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* Jousseaume—Bull. Soc. Zool. France, vii., 1882. Proces Verbaux, p. xxx.
† Dautzenberg and Fischer—Mém. Soc. Zool. France, ix., 1896, p. 57.

OMALAXIS, *Deshayes.*

OMALAXIS MERIDIONALIS, sp. nov.

(Fig. 74.)

Station 13.

Shell small thin rotate, flat above, shallow concave beneath, sides perpendicular. Colour white. In its broken state there remain two whorls and the protoconch. Whorls almost square in section, with a keel projecting at the upper and lower corners. Sutures channelled. Sculpture: above, the upper outer keel stands up from the surface and is constituted by a double bead row; latterly two smaller beads intervene between larger ones. A single narrow bead row runs along the inner margin close to the suture. On the base a single broad elevated bead row forms the outer keel and a narrower row runs along the inner margin. On the side are three evenly spaced raised threads. The space between the bead rows is transversely striated by growth lines. Protoconch tilted, but not sufficiently so to conceal the whorls either from above or from below. Major diam., 4·5 mm.; minor diam., 3·6 mm.; height, 1·25 mm.

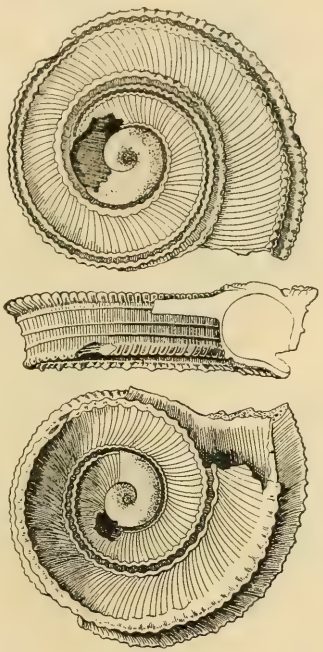

Fig. 74.

The "Thetis" took a very young specimen of an *Omalaxis*, a genus heretofore unknown in Australia. As it was too small to deal with, I have used for my type a broken specimen of an *Omalaxis*, perhaps but not certainly the same species, which was previously dredged in Port Stephens.

From 49-50 fathoms off Cape Three Points.

Family MATHILDIIDÆ.

MATHILDA, *Semper.*

MATHILDA DECORATA, sp. nov.

(Fig. 75.)

Station 49.

Shell small, broad, turretted. Colour pale brown. Whorls four and a half besides the protoconch. Sculpture: a few fine spiral threads ornament the otherwise smooth base, which is bounded by a double smooth cord. On the periphery are two projecting keels which mount the spire; above these are two minor cords, and the suture is bordered by another but plain cord. About twenty-five radial riblets arise outside the basal border and mount perpendicularly to the summit of the shell; they produce a bead at each point of intersection with the four spirals and cut their interstices into square meshes. The protoconch is large, of more than one whorl, and is set on edge at one side of the summit. Aperture subquadrate, outer lip simple, dentate by the sculpture. Columella expanding anteriorly, meeting the lip at an angle. Behind it is an umbilical chink. Length, 4·25 mm.; breadth, 2 mm.

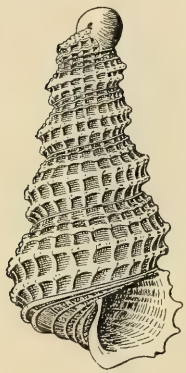

Fig. 75.

This species is closer to the type of the genus than other Australian species which have been referred to *Mathilda*. The apex suggests to me a relationship with *Solarium*.

The "Thetis" took one specimen (the type) in 63 to 75 fathoms off Port Kembla. Others were procured by Mr. G. H. Halligan and myself in 100 fathoms, sixteen miles east of Wollongong. Mr. Halligan has lately taken a larger specimen than here described in 111 fathoms, twelve and a half miles east of Cape Byron.

Family LITIOPIDÆ.

DIALA, *A. Adams.*

DIALA MONILE, *A. Adams*, sp.

Alaba monile, A. Adams, Ann. Mag. Nat. Hist., (3), x., 1862, p. 296.

Diala monile, Smith, Proc. Zool. Soc., 1875, p. 538; *Id.*, Tate & May, Proc. Linn. Soc. N.S. Wales, xxvi., 1901, p. 388.

Station 13.

This species has already been recorded from the coast of New South Wales by Brazier.*

One dead shell from 41-50 fathoms off Cape Three Points.

Family RISSOIDÆ.

RISSOINA, *D'Orbigny.*

RISSOINA CRETACEA, *Ten. Woods.*

Rissoina cretacea, Ten. Woods, Proc. Linn. Soc. N.S. Wales, ii., 1878, p. 265.

(Fig. 76.)

Station 28.

A drawing of the type specimen, preserved in the Australian Museum, of this hitherto unfigured species is here presented.

Two examples occurred in 22 fathoms off the Manning River.

Fig. 76.

SCROBS, *Watson.*

It is to be regretted that Watson did not maintain his first opinion and advance *Scrobs* as a full genus, since by doing so he would have preserved the specific name of his second species. His *Eulima eurychades*† seems to me also to belong here, as Tate has already suggested. Tryon‡ reduced *Scrobs* to a synonym of *Amphithalamus*, Carpenter.§ Since Tryon himself rejects Carpenter's first species as insufficiently known, it cannot in the present state of our knowledge be safely used as the type of a genus.

SCROBS JACKSONI, *Brazier*, sp.

Rissoa (*Scrobs*) *badia*, Watson, Chall. Rep., Zool., xv., 1886, p. 612, pl. xlvi., f. 3 [not *Alvania badia*, A. Ad., Ann. Mag Nat. Hist., (3), viii., 1861, p. 300; nor *Rissoa badia*, Petterd, Journ. Conch., iv., 1884, p. 138].

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* Brazier—Trans. Roy. Soc. S.A., ix., 1887, p. 123.
† Watson—Chall. Rep., Zool., xv., 1884, p. 522, pl. xxxvii., f. 7.
‡ Tryon—Man. Conch., ix., 1887, p. 317.
§ Carpenter—Ann. Mag. Nat. Hist., (3), xv., 1865, p. 181.

Rissoa (*Amphithalamus*) *jacksoni*, Brazier, Proc. Linn. Soc. N.S. Wales, (2), ix., 1895, p. 695.

Station 49.

One specimen from 63-75 fathoms off Port Kembla.

SCROBS SCROBICULATUS, *Watson*, sp.

Rissoa (*Scrobs*) *scrobiculata*, Watson, Chall. Rep., Zool., xv., 1886, p. 611, pl. xlvi., f. 4.

Station 49.

One specimen from 63-75 fathoms off Port Kembla.

SCROBS PYRAMIDATUS, sp. nov.

(Fig. 77.)

Stations 13, 35, 37, 49, 57.

Shell small, ovate, very solid, smooth and glossy. Colour variable, either entirely clear hazel-brown or passing through dull white, and cinereous to heliotrope; the coloured shells usually ivory white on the base and aperture. Sculpture: faint spiral scratches crossed by equally faint growth lines. Whorls four, rounded, last slightly gibbous; first one and a half (? protoconch) spirally grooved, ending in an obscure varix. Suture distinctly impressed. Periphery angled more or less sharply. Base inflated. Aperture ovate, entire, free, simple. The distortion of the last whorl has crumpled a furrow between the aperture and the last whorl, which on the axial region enlarges as a false umbilicus. Height, 2·1 mm.; breadth, 1·4 mm.

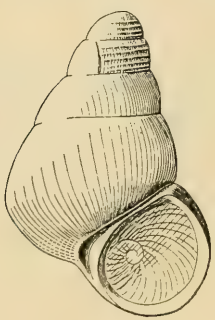

Fig. 77.

This seems a common form, and one characteristic of the continental shelf. It occurred alive in abundance at several of the following stations: 54-59 fathoms off Wata Mooli (type), 50-52 fathoms off Botany, 43-75 fathoms off Port Kembla, 41-50 fathoms off Cape Three Points, and 22-38 fathoms off Port Hacking.

SCROBS BICOLOR, *Petterd*, sp.

Rissoa bicolor, Petterd, Journ. Conch., iv., 1884, p. 137. *Id.*, Tate & May, Proc. Linn. Soc. N.S. Wales, xxvi., 1901, p. 391, pl. xxvi., f. 63.

Stations 13, 28, 33, 37, 49.

From 41-50 fathoms off Cape Three Points; 22 fathoms off the Manning River; 24-27 fathoms in the north end of the Newcastle Bight; 50-52 fathoms off Botany Bay; and 63-75 fathoms off Port Kembla.

SCROBS SALEBROSUS, *Frauenfeld*, sp.

Alvania salebrosa, Frauenfeld, Reise der Novara, Zool. ii., 3, 1868, Moll., p. 11, pl. ii., f 15.

Station 49.

One specimen from 63-75 fathoms off Port Kembla.

ANABRATHRON, *Frauenfeld.*

ANABATHRON CONTABULATUM, *Frauenfeld*, emend.

Anabathron contabulata, Frauenfeld, Reise der Novara, Zool., ii., 3, 1868, Moll., p. 13, pl. ii., f. 20.

Station 49.

Two dead shells from 63-75 fathoms off Port Kembla.

EPIGRUS, gen. nov.

A genus of the *Rissoidæ*, allied to *Scrobs*. Shell tall, slender, smooth, cylindrical. Aperture oblique, appressed; apex large, often protuberant.

Type: *Rissoa ischna*, Tate = *Rissoina cylindracea*, T. Woods.

Other species are *E. dissimilis*, Watson, *E. xanthias*, Watson, *E. petterdi*, Brazier, *E. verconis*, Tate, and *E. simsoni*, Tate & May. This genus has puzzled all writers that encountered it. Tenison Woods placed my type with hesitation in *Rissoina*. Boog Watson referred my second species with serious doubt to *Euima*, my third to *Mucronalia*, and Petterd assigned my fourth to *Rissoa*. Such want of harmony sufficiently indicates the need felt for the introduction of this genus.

EPIGRUS ISCHNUS, *Tate*, sp.

Rissoina cylindracea, Ten. Woods, Proc. Linn. Soc. N.S. Wales, ii., 1878, p. 266 [not *Rissoa cylindracea*, Krynicki, Bull. Soc. Imp. Nat. Moscou, ii., 1837, p. 60].

Rissoa ischna, Tate (*nom. mut.*), Trans. Roy. Soc. S.A., xxiii., 1899, p. 233.

(Fig. 78.)

Station 49.

This species has not yet been figured, a drawing of the author's type of *Rissoina cylindracea*, Ten. Woods, preserved in the Australian Museum, is therefore here inserted. *E. ischnus* and *E. dissimilis* are much alike in shape. Knowing the latter only by the figure, and thinking that the extra whorl of the former accounted for the difference in size, I suggested to Prof. Tate that the two names stood for different growth stages of the same shell. Misled by me, he adopted this view.* Mr. H. L. Kesteven has, however, recently taken and identified *E. dissimilis*, which, set beside half grown *E. ischnus*, proves perfectly distinct. To make this matter clear, I have sketched *E. dissimilis* (fig. 80) and *E. verconis* (fig. 79) to the same scale as *E. ischnus*, drawn above.

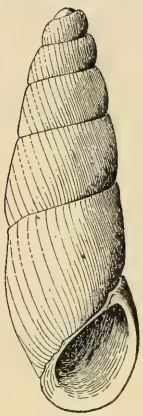

Fig. 78.

I have not been able to compare *Eulima tasmanica*, T. W.† with this species, to which it is said to be related, if not identical.

One half grown shell from 63-75 fathoms off Port Kembla.

Fig. 79. Fig. 80.

EPIGRUS VERCONIS, *Tate*, sp.

Rissoa badia, Petterd, Journ. Conch., iv., 1884, p. 138 [not *Alvania badia*, A. Adams, Ann. Mag. Nat. Hist. viii., 1861, p. 300].

Rissoa verconis, Tate, Trans. Roy. Soc. S.A., xxiii., 1899, p. 233. *Id.*, Tate & May, Proc. Linn. Soc. N.S. Wales, xxvii., 1901, p 392, pl. xxvii., f. 86.

Station 49.

One specimen from 63-75 fathoms off Port Kembla.

* Ten. Woods.—Proc. Roy. Soc. Tas., 1875 (1876), p. 29.
† Tate—Proc. Linn. Soc. N.S. Wales, 1901, xxvii., p. 459.

Family CALYPTRÆIDÆ.

CALYPTRÆA, *Lamarck.*

CALYPTRÆA CALYPTRÆFORMIS, *Lamk.*, sp.

Trochus calyptræformis, Lamk., Hist. Nat. Anim. s. vert., vii., 1822, p. 12.

Calyptræa calyptræformis, Tryon, Man. Conch., viii., 1886, p. 122, pl. xxxv., f. 96-9.

Station 49.

Peron, who discovered this species at Maria Island, Tasmania, described it as "une coquille intérieure, qui me semble devoir constituer un genre nouveau, voisin des Trochus, et dont une espèce assez semblable se retrouve fossile à Grignon près Paris."*

The genus or subgenus *Calyptropsis*, proposed by Tate,† does not seem to differ from *Sigapatella*, created by Lesson for the reception of this species.‡

A few specimens from 63-75 fathoms off Port Kembla.

Family XENOPHORIDÆ.

XENOPHORA, *G. Fischer.*

XENOPHORA TATEI, *Harris.*

Xenophora (*Tugurium*) *tatei*, Harris, Brit. Mus. Cat. Tert. Moll. Austr., i., 1897, p. 254, pl. vii., f. 7*a-b*.

Stations 49, 57.

A broken shell, 30 mm. in diameter and apparently half grown, corresponds with actual fossil shells from Muddy Creek, with which I have compared it. This identification adds to the recent fauna another Tertiary survivor.

From 63-75 fathoms off Port Kembla; from 54-59 fathoms off Wata Mooli; and lately taken by Mr. G. H. Halligan and myself in 100 fathoms sixteen miles east of Wollongong.

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* Peron—Voy. Terres Austr., i., 1807, p. 302.

† Tate—Trans. Roy. Soc. S.A., xvii., 1893, p. 330.

‡ Lesson—Voy. Coquille, Zool., ii., 1830, p. 389.

Family NATICIDÆ.

NATICA, *Lamarck.*

NATICA BEDDOMEI, *Johnston.*

Natica beddomei, Johnston, Proc. Roy. Soc. Tas., 1884 (1885), p. 222.

Natica effosa, Watson, Chall. Rep., Zool., xv., 1886, p. 439, pl. xxviii. f. 3.

Station 28.

One specimen from 22 fathoms off the Manning River.

NATICA SAGITTATA, *Menke.*

Natica sagittata, Menke, Moll. Nov. Holl. Spm., 1843, p. 10. *Id.*, Philippi, Conch. Cab., ii., Abth. 1, Natica, 1852, p. 108, pl. xv., f. 14. *Id.*, Watson, Chall. Rep., Zool., xv., 1886, p. 433.

Station 28.

Two shells from 22 fathoms off the Manning River.

Family EULIMIDÆ.

EULIMA, *Risso.*

EULIMA MUNITA, sp. nov.

(Fig. 81.)

Stations 13, 57.

Shell pyramidal, imperforate, axis slightly curved, broad at the base, tapering to a sharp and slender point, thin, translucent and glossy. Colour white, the contained animal lending to the lower whorls a purple and to the upper an orange tinge. Whorls eleven, flattened, contracted at the suture and subangled at the base. The varices project as prominent buttresses: they

are irregularly disposed and may or may not continue from whorl to whorl. The surface is sculptured with shallow, sometimes punctate grooves. Aperture large, oblique, subquadrate, thin; outer lip thin, everted; inner lip spreading a callus sheet on the body whorl; columella broad, rather straight, deeply inserted. Length, 8 mm.; breadth, 3·75 mm.

A few living specimens were taken in 41-50 fathoms off Cape Three Points; off Wata Mooli in 54-59 fathoms.

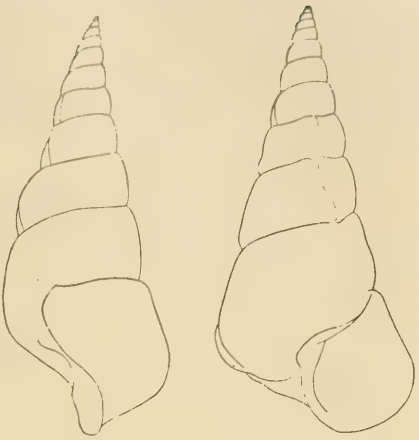

Fig. 81.

EULIMA AUGUR, *Angas.*

Eulima augur, Angas, Proc. Zool. Soc., 1865, p. 56. *Id.*, Sowerby, Conch. Icon., xv., 1866, Eulima, pl. vi., f. 47. *Id.*, Tate, Trans. Roy. Soc., S.A., xxii., 1898, p. 80.

Eulima proxima, Sowerby, Conch. Icon, xv., 1866, Eulima, pl. vi., f. 48 (*fide* Tate).

Station 37.

One example from 50-52 fathoms off Botany Bay.

MELANELLA, *Bowdich.*

Dall has suggested* the separation of the humpbacked Eulimas under the name of *Melanella*, Bowdich, 1822, a name which precedes *Eulima*, Risso, 1826.

MELANELLA COMMENSALIS, *Tate*, sp.

Eulima commensalis, Tate, Trans. Roy. Soc. S.A., xxii., 1898, p. 82, pl. iv. *bis.*, f. 2.

Station 13.

Previously collected, as noted in the original description, from Port Stephens.

Three examples from 41-50 fathoms off Cape Three Points.

* Dall—Bull. Mus. Comp. Zool., xviii., 1889, p. 376.

MELANELLA INDISCRETA, *Tate*, sp.

Eulima indiscreta, Tate, Trans. Roy. Soc. S.A., xxii., 1898, p. 82, pl. iv. *bis.*, f. 3.

Station 13.

Already noted by Prof. Tate from Port Stephens.
A single specimen from 41-50 fathoms off Cape Three Points.

LEIOSTRACA, *H. & A. Adams.*

LEIOSTRACA LODDERÆ, *Hedley.*

Eulima vitrea, Petterd, Journ. Conch., iv., 1884, p. 136 [not *Eulima vitrea*, A. Ad., Thes. Conch., ii., 1854, p. 799, pl. clxix., f. 35].

Eulima loddereæ (Tate, MS.), Lodder, Proc. Roy. Soc. Tas. 1898-1899 (1900), p. 135; repudiated, Tate, Proc. Linn. Soc. N.S. Wales, xxvi., 1901, p. 446.

(Fig. 82.)

Station 13.

Shell acicular, smooth, glossy, transparent or opaque, without varices. Colour: the opaque or semitransparent shells are milk-white, with a dull opaque band above the sutures, next above which is an indistinct, often interrupted orange line; another orange line runs round the periphery of the last whorl and tinges the outer lip. Whorls twelve, with straight sides, parted by a linear suture. Base attenuated. Aperture rather oblique, narrowly pyriform, effuse anteriorly, posteriorly subchannelled, a thin callus on the body whorl, columella slightly curved, thickened within. Length, 7·7 mm.; breadth, 1·2 mm.

Fig. 82.

This species has a general resemblance to *L. bivittata*, H. & A. Ad.,* but as that is described as having from nine to ten whorls in a length of 14 mm., I consider it distinct. Mr. W. F. Petterd has kindly identified my specimen as his *Eulima vitrea*, of which the description suits a half grown *L. loddereæ*. The decision of Tate & May† that *E. vitrea*, Petterd, is *Leiostraca bivittata* seems to me not in accord with the proportions noted for each. Other allied species are *Leiostraca samoensis*, Crosse,‡ longer, and in proportion much

* H. & A. Ad.—Thes. Conch., ii., 1854, p. 804, pl. 170, f. 18, 19.
† Tate & May—Proc. Linn. Soc. N.S. Wales, xxvi., 1901, p. 381.
‡ Crosse—Journ. de Conch., xv., 1867, p. 300, pl. xi., f. 3.

broader, and *Eulima acerrima*, Watson,* which has the same number of whorls as *L. subtilis* in half the total length.

A few specimens from 41-50 fathoms off Cape Three Points. A small series taken by Mr. A. U. Henn in 10½ fathoms off Bow Reef, near Cape Sidmouth, North Queensland, possesses a third orange line around the base, but otherwise so closely agree that I regard them as belonging to this species.

PSEUDORISSOINA, *Tate & May.*

PSEUDORISSOINA EXIGUA, sp. nov.

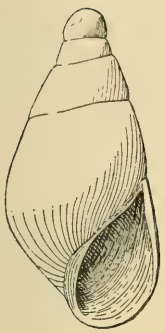

Fig. 83.

(Fig. 83.)

Station 13.

Shell small, smooth, glossy, solid, imperforate, ovate. Colour white. No sculpture. Whorls three, plus a swollen heterostrophe two-whorled protoconch, last whorl exceeding the remainder of the shell, subangled at the periphery. Aperture pyriform, slightly oblique, outer lip simple, columella broad, reflected, margins united by a callus. Height, 1·25 mm.; diam., 0·6 mm.

Six specimens from 41-50 fathoms off Cape Three Points.

STILIFER, *Broderip.*

STILIFER BRAZIERI, *Angas.*

Stylifer brazieri, Angas, Proc. Zool. Soc., 1877, p. 173, pl. xxvi, f. 12.

Station 48.

A shell containing the animal shows this species to possess an operculum, a feature at variance with the generic characters. If I have correctly identified the species, the original figure is a bad one. If respect were paid to it, and if the illustrations of small shells of this author were not known to be untrustworthy, the subject of this notice would be described as new.

A single specimen from 55-56 fathoms off Wollongong.

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* Watson—Chall. Rep., Zool., xv., 1886, p. 513, pl. xxxvi., f. 1.

Family PYRAMIDELLIDÆ.

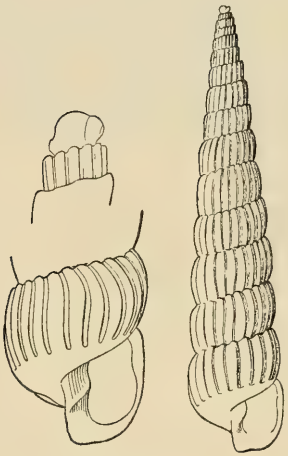

Fig. 84.

TURBONILLA, *Risso.*

TURBONILLA SCALPIDENS, *Watson*, sp.

Odostomia (*Turbonilla*) *scalpidens*, Watson, Chall. Rep., Zool., xv., 1886, p. 489, pl. xxxii., f. 1.

(Fig. 84.)

Stations 13, 35, 37, 49, 57.

A few specimens at each locality from 41-50 fathoms off Cape Three Points, 63-70 fathoms off Port Kembla, and 49-54 fathoms off Wata Mooli; 50-52 fathoms off Botany Bay; 22-38 fathoms off Port Hacking.

SYRNOLA, *A. Adams.*

SYRNOLA MACROCEPHALA, sp. nov.

(Fig. 85.)

Station 49.

Shell smooth, subulate, slightly tapering, last whorl rather suddenly increasing, and sharply angled at the periphery. Colour pale straw, base and a subsutural band white. Apex apparently heterostrophe, following whorl swollen, next narrower; as the whorls progress they become slightly flatter. Whorls nine, parted by a deeply channelled suture. Aperture with a single slight fold. Length, 6 mm.; breadth, 1·5 mm.

A single specimen with a broken lip from 63-75 fathoms off Port Kembla.

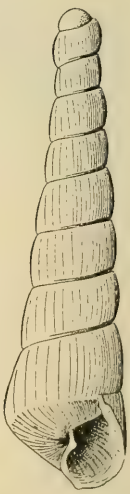

Fig. 85.

MYXA, gen. nov.

A genus of the Pyramellidæ, umbilicate, with few whorls, no columella fold, and the lip produced anteriorly.

Type *M. exesa.*

This genus might be taken for *Niso*, if it were not for the heterostrophe apex; so that it bears the same relation to *Niso* as *Eulimella* does to *Eulima.*

MYXA EXESA, sp. nov.

(Fig. 86.)

Station 13.

Shell small, thin, translucent, smooth, conical. Colour white. Whorls slightly rounded, four and a half, besides a few whorled perpendicular heterostrophe apex. Suture channelled, periphery keeled, base flattened. Umbilicus broad and deep, infundibuliform, angled at the margin. Aperture elliptical, produced anteriorly in a spout. Length, 1·6 mm.; breadth, 0·8 mm.

Several specimens from 41-50 fathoms off Cape Three Points.

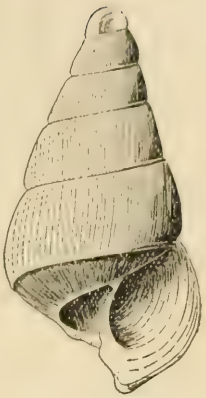

Fig. 86.

ODONTOSTOMIA, *Jeffreys.*

As the name *Odostomia* and *Odontostomia* are generally misunderstood, it may be well to here recall that Dall has pointed out* that *Odostomia* was proposed by Fleming† for certain land shells, and that strictly speaking it is a synonym of *Pupa*. *Odontostomia* was introduced by Jeffreys‡ in connection with a single species, the *Turbo plicatus* of Montagu.

ODONTOSTOMIA NUGATORIA, sp. nov.

(Fig. 87.)

Stations 13, 49.

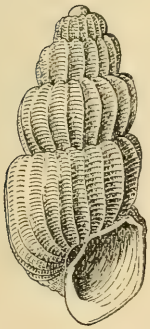

Fig. 87.

Shell small, oblong. Colour white. Whorls four, plus a tilted heterostrophe apex. Spire subgradate. Sculpture: each adult whorl bears numerous stout projecting perpendicular ribs crossed by fine spiral grooves. Aperture subquadrate, plication more apparent in immature shells; columella reflected, lip anteriorly effuse. Base more or less perforate. Length, 2·2 mm.; breadth, 1·0 mm.

A few specimens from 41-50 fathoms off Cape Three Points, and from 63-75 fathoms off Port Kembla.

* Dall—Trans. Wagner Inst., iii., 1892, p. 248.
† Fleming—Edinburgh Encyclopædia, vii., 1813.
‡ Jeffreys—Malacological and Conchological Magazine, Part ii., 1839, p. 34.

Family SCALIDÆ.

SCALA, *Humphrey.*

SCALA MORCHI, *Angas.*

Scala (*Cirsotrema*) *morchi*, Angas, Proc. Zool. Soc., 1871, p. 15, pl. i., f. 7 [not *Scalaria morchi*, Sowerby, Conch. Icon., xix., 1873, Scalaria, pl. x., sp. 76 = *Scalaria* (*Psychrosma*) *erronea*, Tapparone-Canefri, Journ. de Conch., xxiv., 1876, p. 155].

Stations 28, 33, 57.

This species exceeds the size indicated by its author, one of the "Thetis" specimens reaching ten whorls in a length of 11·5 mm. Tapparone-Canefri rightly pointed out that Sowerby's figure and description do not suit Angas' species, but, before burdening literature with a new name, he ought to have ascertained if that figure was based on fact or fiction.

From 22 fathoms off the Manning River, from 24-27 fathoms in the north end of the Newcastle Bight, and from 54-59 fathoms off Wata Mooli; in each case a single specimen.

Class STENOGLOSSA.

Family OLIVIDÆ.

ANCILLA, *Lamarck.*

ANCILLA OBLONGA, *Sowerby.*

Ancillaria oblonga, Sowerby, Spec. Conch., 1830, p. 7, f. 38, 39.

Station 48.

One specimen from 55-56 fathoms off Wollongong.

OLIVELLA, *Swainson.*

OLIVELLA BRAZIERI, *Angas.*

Olivella brazieri, Angas, Proc. Zool. Soc., 1877, p. 172, pl. xxvi., f. 6.

Station 28.

Angas described and figured this from an immature example. The "Thetis" collection shows the species as attaining a

length of 14·5 mm. and a breadth of 5 mm. in 5½ whorls. It much resembles *O. leucozona*, Adams & Angas, from Tasmania, a smaller but proportionately broader shell. The records of *O. leucozona* from New South Wales are, I believe, erroneous.

Several specimens from 22 fathoms off the Manning River.

Family MARGINELLIDÆ.

MARGINELLA, *Lamarck.*

MARGINELLA KEMBLENSIS, sp. nov.

(Fig. 88.)

Station 49.

Shell narrowly biconical, solid, glossy, with an elevated spire, blunt at the apex. Colour milk white. Whorls five, swollen at the shoulder, thence flattened to the suture, and there somewhat constricted. Aperture narrow, almost linear, rounded and effuse anteriorly. Outer lip ascending at its insertion, strongly varixed, bearing within a single tubercle at a third of the length from the posterior end; columella with four widely spaced, well developed folds. Length, 5·2 mm., breadth, 2 mm.

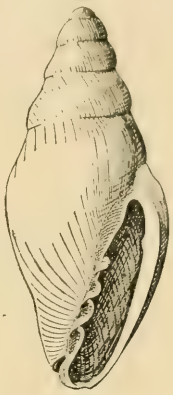

Fig. 88.

Three specimens from 63-75 fathoms off Port Kembla.

MARGINELLA TURBINATA, *Sowerby.*

Marginella turbinata, Sowerby, Thes. Conch., i., 1846, p. 385, pl. lxxv., f. 70, 71. *Cryptospira turbinata*, Jousseaume, Rev. Mag. Zool., (3), iii., 1875, p. 238.

Station 49.

Three specimens from 63-75 fathoms off Port Kembla.

MARGINELLA LÆVIGATA, *Brazier* (emend).

(Fig. 89.)

Marginella lavigata, Brazier, Proc. Linn. Soc. N.S. Wales, i., 1876 (1877), p. 225. *M. lævigata*, Hedley, Rec. Austr. Mus., iv., 1901, p. 123, pl. xvi., f. 5.

M. valida, Watson, Chall. Rep., Zool., xv., 1886, p. 267, pl. xvi., f. 3 (young).

Stations 13, 28, 37, 49, 57.

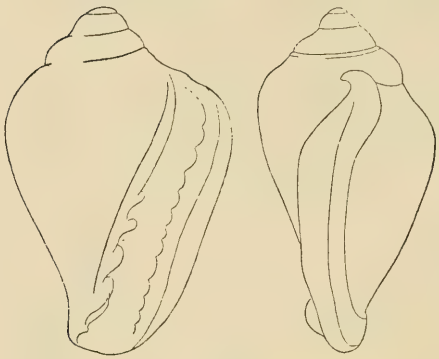

Fig. 89.

Specimens of this, from 24 fathoms off Cabbage Tree Island, Port Stephens, in the Museum were labelled by Mr. J. Brazier as "*Erato angistoma*," Gray,* which it certainly is not. Probably that species ought to be expunged from our list.†

Numerous specimens from 63-75 fathoms off Port Kembla, and a few from 43-50 off Cape Three Points, from 22 fathoms off the Manning River, from 50-52 fathoms off Botany Bay, from 54-59 fathoms off Wata Mooli.

MARGINELLA OCHRACEA, *Angas.*

Marginella ochracea, Angas, Proc. Zool. Soc., 1871, p. 14, pl. i., f. 6.

Egouena ochracea, Jousseaume, Rev. Mag. Zool., (3), iii., 1875, p. 197.

Stations 13, 22, 49.

Numerous specimens from 63-75 fathoms off Port Kembla, and from 22 fathoms off the Manning River, from 41-50 fathoms off Cape Three Points.

MARGINELLA MUSTELINA, *Angas*, sp.

Hyalina (Volvarina) mustelina, Angas, Proc. Zool. Soc., 1871, p. 14, pl. i., f. 5.

Marginella stanislas, Ten. Woods, Proc. Roy. Soc. Tas., 1876 (1877), p. 133. *Id.*, Tate & May, Proc. Linn. Soc. N.S. Wales, xxvi., 1901, p. 362, pl. xxvi., f. 82.

Station 49.

In support of the above novel synonomy, it may be remarked that this species is subject to much variation. The length ranges

* Gray, in Sowerby—Conch. Illust., 1841, f. 51.

† Whitelegge—Journ. Roy. Soc. N.S. Wales, xxiii., 1889 (1890), p. 250.

from 7·5 to 5 mm.; the colour pattern from the ornate form figured by Angas to pure white; while the lip may be smooth as described by Woods, or denticulated as stated by Angas. The name *stanislas* may be retained in a varietal sense for the large white form which in warmer latitudes is restricted to deep water.

In 63-75 fathoms off Port Kembla.

MARGINELLA STILLA, sp.nov.

(Fig. 90.)

Station 49.

Shell drop-shaped, solid, glossy, with slightly elevated spire. Colour: the dorsal surface cream, varix and ventral surface white. Whorls four. Aperture narrow; outer lip with a strong varix, mounting to the suture of the penultimate whorl, within finely denticulate, columella with four well developed teeth. Length 5, breadth 2·5 mm.

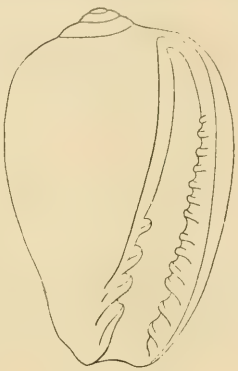

Fig. 90.

M. agapeta, Watson, which I have not seen, must resemble this, but that has a different shape and three columella plaits. There is a variety of *M. stilla* in which the spire is more depressed than in the type figured, so that the length of the shell hardly exceeds that of the aperture.

Apparently this is a common and widely distributed species on the continental shelf. The "Thetis" took it in 63-75 fathoms off Port Kembla, and it was previously obtained in 24 fathoms off Cabbage Tree Island, Port Stephens.

MARGINELLA STRANGEI, *Angas.*

Marginella strangei, Angas, Proc. Zool. Soc., 1877, p. 172, pl. xxvi., f. 8. *Id.*, Hedley, Proc. Linn. Soc. N.S. Wales, xxvii., 1902, p. 18, text figure.

Stations 28, 49.

From 22 fathoms off the Manning River, and from 63-75 fathoms off Port Kembla. Previously taken in 24 fathoms off Cabbage Tree Island, Port Stephens.

MARGINELLA ANGASI, *Brazier.*

Marginella angasi (Brazier), Crosse, Journ. de Conch., xviii., 1870, p. 304. *Id.*, Crosse, *loc. cit.*, xix., 1871, p. 324, pl. xii., f. 3.

Granula angasi, Jousseaume, Rev. Mag. Zool., (3), iii., 1875, p. 247.

Stations 13, 22, 49.

This species ranges north at least as far as the Thirteenth Parallel. Watson incorrectly refers to this as having a single columella fold ; the only difference apparent to me between his *M. pachia** and *M. angasi* is that the former is twice the size of the latter.

Off Cape Three Points in 63-75 fathoms, and off Port Kembla in 41-50 fathoms, off the Manning River in 22 fathoms.

MARGINELLA PUMILIO, *Tate & May.*

Marginella minutissima, Ten. Woods, Proc. Roy. Soc. Tas., 1875 (1876), p. 27.

M. pumilio, Tate & May, Proc. Linn. Soc. N.S. Wales, xxvi., 1901, p. 363, pl. xxvi., f. 79.

Station 49.

Tate and May reject the name of Tenison Woods as preoccupied by Michelin ; I have not been able to ascertain where Michelin's name appeared.

One specimen from 63-75 fathoms off Port Kembla.

MARGINELLA MULTIPLICATA, *Tate & May.*

Marginella multiplicata, Tate & May, Trans. Roy. Soc. S.A., xxiv., 1900, p. 91. *Id.*, Tate & May, Proc. Linn. Soc. N.S. Wales, xxvi., 1901, p. 364, pl. xxvii., f. 88.

Station 49.

An immature specimen from 63-75 fathoms off Port Kembla.

MARGINELLA NYMPHA, Brazier.

Marginella nympha, Henn & Brazier, Proc. Linn. Soc. N.S. Wales, (2), ix., 1894, p. 168, pl. xiv., f. 2.

Station 13.

Two specimens from 41-50 fathoms off Cape Three Points.

* Watson—Chall. Rep., Zool., xv., 1885, p. 265, pl. xvi., f. 5.

MARGINELLA CRATERICULA, *Tate & May.*

Marginella craterícula, Tate & May, Trans. Roy. Soc. S.A., xxiv., 1900, p. 91. *Id.*, Tate & May, Proc. Linn. Soc. N.S. Wales, xxvi., 1901, p. 363, pl. xxvi., f. 74.

Stations 28, 49.

One example from 63-75 fathoms off Port Kembla; another from 22 fathoms off the Manning River.

While on the subject of *Marginella* I may remark that in the use of *M. ovuloformis*, Tate & May,* were anticipated by *M. ovuliformis*, D'Orb.† I therefore suggest for the Tasmanian shell the epithet *Marginella ventricosa*.

MARGINELLA WHANI, *Pritchard & Gatliff.*

Marginella whani, Pritchard & Gatliff, Proc. Roy. Soc. Vict., (2), xiii., 1900, p. 137, pl. xxi., f. 5, 6.

Station 49.

The "Thetis" shells are 6·5 mm. long and 3 mm. broad, whereas the type is 11 mm. long and 5 mm. broad. Except for the difference in size, the New South Wales shells answer well to the original figure and description. In several cases, *e.g.*, *Volvula rostrata*, A. Ad., specimens from New South Wales are dwarfs compared to those from the southern States. Mr. A. Hamilton tells me that he has remarked analogous cases in New Zealand.

From 63-75 fathoms off Port Kembla; previously taken in 24 fathoms off Cabbage Tree Island, Port Stephens, and recently by Mr. G. H. Halligan and myself in 100 fathoms sixteen miles east of Wollongong.

MARGINELLA OLIVELLA, *Reeve.*

Marginella olivella, Reeve, Conch. Icon., xv., 1865, pl. xxv. f. 140 [not *Marginella olivella*, Ortmann, Rep. Princeton Univ. Exped. Patagonia, iv., 1902, p. 225, pl. xxxv., f. 3.]

Marginella simplex, Reeve, Conch. Icon., xv., 1865, pl. xxii., fig. 115 [not *Marginella simplex*, F. E. Edwards, Mon. Eocene Moll., Gt. Brit., Part 3 (Pal. Soc. viii.), 1854, p. 143, pl. xviii., fig. 8*a-c*].

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* Tate & May—Trans. Roy. Soc. S.A., xxiv., 1900, p. 91.

† D'Orbigny—Moll. Cuba., ii., 1853, p. 101, pl. xx., f. 34-5.

Cryptospira infelix, Jousseaume, Rev. Mag. Zool., (3), iii., 1875, p. 238.

Stations 28, 33, 49.

A few specimens from 22 fathoms off the Manning River, 24-27 fathoms in the north end of the Newcastle Bight, and 63-75 fathoms off Port Kembla.

Family VOLUTIDÆ.

VOLUTA, *Linne.*

VOLUTA UNDULATA, *Lamarck.*

Voluta undulata, Lamarck, Ann. Mus. Hist. Nat., v., 1804, p. 157, pl. xii., f. 1*a*, *b*.

Voluta undulosa, Peron, Voy. Terres. Australes, i., 1807, p. 302.

Station 25.

The bibliography of this species is extensive; most of the earlier references are given by Deshayes,* and most of the later by Pritchard and Gatliff.†

One living specimen from 42-48 fathoms off Newcastle.

VOLUTA FUSIFORMIS, *Swainson.*

Voluta fusiformis, Swainson, Appendix to Bligh's Catalogue, 1822. [Reprinted, Exotic Conchology, 2nd Ed., 1841, p. 37.] *Id.*, Sowerby, Thes. Conch., ii., 1844, p. 208, pl. liv., f. 100.

Voluta sowerbyi, Kiener, Coq. Viv., 1839, Voluta, p. 47, pl. l. [*fide* Crosse, Journ. de Conch., xix., 1871, p. 297], not *Voluta fusiformis*, Kiener, 1839.

Stations 22, 34.

A few dead shells from 36-39 fathoms off Port Jackson, and from 26-40 fathoms in the Newcastle Bight.

VOLUTA MARMORATA, *Swainson.*

Voluta marmorata, Swainson, Exotic Conchology, 1822, pl. i.

Station 13.

One specimen alive from 41-50 fathoms off Cape Three Points.

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* Deshayes—Hist. Nat. Anim. s. vert., x., 1844, p. 401.

† Pritchard & Gatliff—Proc. Roy. Soc. Vict., x., (2), 1898, p. 280.

VOLUTA MAGNIFICA, *Chemnitz.*

Voluta magnifica, Chemnitz, Conch. Cab., xi., 1795, p. 8, pl. 174, 175, f. 1693, 1694.

Station 25.

The statement of Chemnitz that this species inhabits Norfolk Island was copied by subsequent authors, but is, I believe, incorrect.

Alive from 42-48 fathoms off Newcastle.

VOLUTA MAMILLA, Gray.

Voluta mamilla, Gray in Sowerby, Thes. Conch., i., 1844, p. 207, pl. l., f. 57, 58. *Id.*, Dautzenberg, Journ. de Conch., xlix., 1901, p. 10, pl. ii. f. 1.

Voluta mammilla, Sowerby, Proc. Zool. Soc., 1844, p. 149.

Stations 37, 44.

A specimen from station 37 is larger than any record, being 293 mm. (11½ inches) long and 155 broad; the weight is 12½ oz. For its size the species is thin and light.

Mr. J. Milligan described* this shell as used by the blacks of Circular Head, Tasmania, for carrying water in the same way that the Queensland Aborigines employ *Melo*.

Alive from 50-52 fathoms off Botany Bay, and dead from 49-50 fathoms off Coogee.

MICROVOLUTA, *Angas.*

MICROVOLUTA AUSTRALIS, *Angas.*

Microvoluta australis, Angas, Proc. Zool. Soc., 1877, p. 35, pl. v., f. 2. *Id.*, Brazier, Ann. Rept. Austr. Mus. for 1881 (1882), p. 20, 21. *Id.*, Tryon, Man. Conch., iv., 1882, p. 105, pl. xxxi., f. 151, 152.

Voluta minima, Sowerby, Thes. Conch., v., 1887, p. 300, pl. 515, f. 86.

Stations 23, 49.

Taken in 16-19 fathoms in the Newcastle Bight, and in 63-75 fathoms off Port Kembla. Brazier has also reported it from 35 fathoms off Broughton Islands, and from 24 fathoms off Cabbage Tree Island.

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* Milligan—Proc. Roy. Soc. V.D. Land, 1854, p. 159.

Family MITRIDÆ.

MITRA, *Lamarck.*

MITRA STRANGEI, *Angas.*

Mitra (Caucilla) strangei, Angas, Proc. Zool. Soc., 1867, p. 110, pl. xiii., f. 4.

Stations 37, 49.

Mitra franciscana, Ten. Woods,* is very closely allied to this.

Several specimens from 63-75 fathoms off Port Kembla, and one from 50-52 fathoms off Botany.

TURRIS, *Montfort.*

TURRIS TASMANICA, *Ten. Woods*, sp.

Mitra tasmanica, Ten. Woods, Proc. Roy. Soc. Tas., 1875 (1876), p. 136.

Station 49.

I submitted a specimen, dredged by Mr. G. H. Halligan and myself in 100 fathoms, sixteen miles east of Wollongong, to Mr. W. L. May, who, having compared it with the type, writes (27 July, 1903):—"The shell (from Wollongong) is just about the same form as ours (*i.e.*, the Tasmanian), though smaller; it however differs considerably in detail, it has flatter and more tabulated whorls, and the whole shell has a sharper, more clean cut appearance. The ribs are about the same, only more distinct, but whilst in our shell the cross sculpture consists of fine close striæ, this has sharp little keels, separated by an appreciable interval, and therefore very much less numerous. It might perhaps be considered a distinct variety."

Two young shells from 63-75 fathoms off Port Kembla. Previously dredged off Cabbage Tree Island, Port Stephens.

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* Ten. Woods—Proc. Roy. Soc. Tas., 1876 (1877), p. 133.

Family FUSIDÆ.

FUSUS, *Lamarck.*

FUSUS WAITEI, sp. nov.

(Pl. xxxvii.)

Stations 12, 56.

Shell large, fusiform, spire gradate. Colour dull white. Whorls exceeding eight; angled at the shoulder, thence concave to the suture. Sculpture: broad rounded ribs, numbering fourteen on the last whorl, project boldly at the shoulder, descend perpendicularly and vanish gradually on the base. These and the rest of the shell are crossed by equally spaced strong spiral cords. Under the lens growth striæ are seen to roughen the whole surface. Aperture oval, on the inner lip the surface is excavated and smoothed. Canal long, open, sinuate. Length, 150 mm.; breadth, 60 mm.

The nearest ally appears to be *Fusus crebriliratus*, Reeve,* than which the novelty is larger, broader, and has more developed ribs.

One specimen, the type, from 79-80 fathoms off Botany Bay; and another from 23-34 fathoms off Cape Three Points.

Family FASCIOLARIIDÆ.

FASCIOLARIA, *Lamarck.*

FASCIOLARIA AUSTRALASIA, *Perry*, sp.

Pyrula australasia, Perry, Conchology, 1811, pl. liv., f. 1.

Stations 41, 44, 56.

This species has not hitherto been found upon this coast. Verco has stated that:—"The shell which has hitherto been considered as *F. fusiformis* among local collectors is only a comparatively smooth variety of *F. coronata.*" The usual acceptation of *F. fusiformis* was in my mind when I wrote† that *Pyrula australasia*, Perry, was *Fasciolaria fusiformis*, Valenciennes.

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* Reeve—Conch. Icon., iv., Fusus, 1847, pl. v., f. 20.
† Hedley—Proc. Linn. Soc. N.S.W., xxvii., 1902, p. 27.

Off Coogee in 49-50 fathoms; off Wata Mooli in 52-71 fathoms; and off Botany Bay in 79-80 fathoms.

FASCIOLARIA AUSTRALASIA, var. CORONATA, *Lamarck.*

Fasciolaria coronata, Lamarck, Hist. Nat. Anim. s. vert., vii., 1822, p. 120. *Id.*, Kiener, Coq. Viv., Fasciolaria, 1840, p. 9, pl. ix., f. 1. *Id.*, Verco, Trans. Roy. Soc. S.A., xix., 1895, p. 107, pl. iii. f. 3 (radula).

Station 46.

Off Jibbon in 50-66 fathoms.

Family BUCCINIDÆ.

SIPHONALIA, *A. Adams.*

SIPHONALIA MAXIMA, *Tryon.*

Siphonalia maxima, Tryon, Man. Conch., iii., 1881, p. 135, pl. 54, f. 355.

(Pl. xxxviii.)

Stations 13, 41, 44.

Tryon's figure and description are both unsatisfactory. The species attains greater size than he indicates; a decollated shell before me, of which $8\frac{1}{2}$ whorls remain, is 237 mm. long and 100 mm. broad, thus exceeding the original dimensions by about two inches. In general shape narrow fusiform; whorls of the spire angled in the middle, the angle cut into 12-14 sharp projecting nodules. On last whorl the angle occurs above the flattened periphery, base excavated. Ground colour cream on which chocolate appears everywhere in dots or lines. On the base these gather into obscure bands; between the peripheral nodules and on the tip of the canal the chocolate appears in darker patches. Entire surface covered with flat topped spiral riblets parted by wide and shallow furrows. Outer lip denticulate at the edge by external sculpture, lirate within. Inner lip a mere smear of callus. Canal broad, open, varying from nearly straight to flexed in an S curve.

The series at my disposal is imperfect, but so far as it goes it leads me to dissent from the following opinion so emphatically expressed by Prof. Tate* and endorsed by Pritchard & Gatliff:†

* Tate—Trans. Roy. Soc. S.A., xiv., 1891, p. 257.
† Pritchard & Gatliff—Proc. Roy. Soc. Vict., (2), x., 1898, p. 273.

"After lengthened study of considerable material and having traced up specimens of *S. tasmaniensis*, from three-fourths of an inch in length to those of seven inches, I have no hesitation in regarding *S. maxima* as the senile stage of *S. tasmaniensis*." In all stages *S. maxima* appears to me to be of more slender proportions, though absolutely larger, the whorls to have a more acute angle with fewer bolder nodules, and the canal to be longer and more bent.

The species seems to be not distantly related to *Megalatractus aruanus*, Linn.

Alive from 41-50 fathoms off Cape Three Points; dead from 52-71 fathoms off Wata Mooli, and 49-50 fathoms off Coogee. In 1891 the Museum received specimens taken alive off Broken Bay by the Deep Sea and Trawling Syndicate.

CYLLENE, *Gray.*

CYLLENE LACTEA, *Adams & Angas.*

Cyllene lactea, Adams & Angas, Proc. Zool. Soc., 1863, p. 422.
Id., Hedley, Proc Linn. Soc. N.S. Wales, xxvi., 1901, p. 19, pl. ii., f. 10.

Station 33.

One dead shell from 24-27 fathoms at the north end of the Newcastle Bight.

FASCINUS, gen. nov.

A genus of the *Buccinidæ* related to *Hindsia*. Animal unknown. Shell oblong, with a large protoconch and four adult whorls. Sculpture: coarse spirals crossed by delicate radials. Spire unbroken by varices, but a well developed varix stands behind the aperture. In the posterior angle of the mouth a tubercle, on the columella no plications. Canal broad, short and open.

Type, *F. typicus*, Hedley.

Without the aid of the soft parts this genus cannot be finally classified. In several respects it recalls *Colubraria*, but lacks the varices on the upper whorls. Again, it shares some aspects of *Nassa*, but the pattern of its sculpture is foreign to that group. The large apex and absence of columella plications sever it from *Hindsia*.

FASCINUS TYPICUS, sp. nov.

(Fig. 91).

Stations 49, 55.

Shell oblong elevated, rather thin. Whorls four (excluding the protoconch) wound obliquely, contracted at the suture. Protoconch dome-shaped, smooth, glossy, of two whorls, the first minute, the second large. Colour uniform pale yellow. Sculpture: the earlier whorls have each three elevated spiral keels, the upper smaller; below the periphery of the last whorl is another large keel, followed by a series of successively diminishing close spirals. The spiral sculpture is overridden by fine widely spaced radial threads. Aperture fortified by an expanded varix of the *Lotorium* pattern. Throat smooth. Canal short, slightly recurved. Length, 6·25 mm.; breadth, 3 mm.

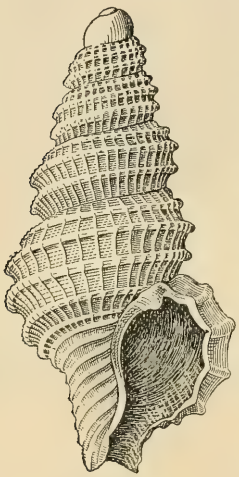

Fig. 91.

One (the type) from 63-75 fathoms off Port Kembla; a young shell 11-15 fathoms off the Crookhaven River. Also dredged in 100 fathoms by Mr. G. H. Halligan and myself sixteen miles east of Wollongong.

Family NASSIDÆ.

NASSA, *Lamarck.*

NASSA JACKSONIANA, *Quoy & Gaimard*, sp.

Buccinum jacksonianum, Quoy & Gaim., Voy. Astrolabe, Zool., ii., 1832, p. 452, pl. xxxii., ff. 28, 29 [not *Buccinum jacksonianum*, Kiener, Coq. Viv., ix., 1834, p. 64, pl. xix., f. 3—*fide* Deshayes, Hist. Nat. Anim. s. vert., x., 1844, p. 184, footnote].

Stations 13, 22, 33, 35, 37, 49, 57.

The variety taken by the "Thetis" is small and solid, apparently the form described by Tenison Woods as *Nassa tasmanica*.*

* Ten. Woods—Proc. Roy. Soc. Tas., 1875 (1876), p. 150.

Abundant in all stages of growth from 41-50 fathoms off Cape Three Points; from 63-75 fathoms off Port Kembla; from 22 fathoms off Manning River; from 54-59 fathoms off Wata Mooli; from 50-52 fathoms off Botany Bay; from 24-27 fathoms in the north end of the Newcastle Bight; and from 22-38 fathoms off Port Hacking.

NASSA PERITREMA, *Ten. Woods.*

Nassa peritrema, Ten. Woods, Proc. Linn. Soc. N.S. Wales, iv., 1880, p. 21, pl. iv., fig. 5, 5*a*.

Stations 28, 33.

One specimen from 22 fathoms off the Manning River, two from 24-27 fathoms in the north end of the Newcastle Bight.

Family COLUMBELLIDÆ.

COLUMBELLA, *Lamarck.*

COLUMBELLA FILOSA, *Angas*, sp.

Æsopus filosus, Angas, Proc. Zool. Soc., 1867, p. 111, pl. xiii., fig. 6.

Stations 33, 57.

From 24-27 fathoms at the north end of the Newcastle Bight; and from 54-59 fathoms off Wata Mooli.

COLUMBELLA ATTENUATA, *Angas.*

Columbella attenuata, Angas, Proc. Zool. Soc., 1871, p. 14, pl. i., f. 4.

Stations 33, 49.

From 24-27 fathoms at the north end of the Newcastle Bight; and 63-75 fathoms off Port Kembla.

COLUMBELLA LINCOLNENSIS, *Reeve.*

Columbella lincolnensis, Reeve, Conch. Icon., xi., 1859, pl. xxix., f. 184*a*, *b*.

Stations 13, 28, 48, 57.

From 41-50 fathoms off Cape Three Points; from 22 fathoms off the Manning River; from 54-59 fathoms off Wata Mooli; and from 55-56 fathoms off Wollongong.

COLUMBELLA ANGASI, *Brazier.*

Columbella interrupta, Angas, Proc. Zool. Soc., 1865, p. 56, pl. ii., ff. 9, 10 [not *Columbella interrupta*, Gaskoin, Proc. Zool. Soc., 1851, p. 3].

Columbella angasi, Brazier, Proc. Zool. Soc., 1871, p. 322.

Station 59.

One specimen from 54-59 fathoms off Wata Mooli.

COLUMBELLA PLURISULCATA, *Reeve.*

Columbella plurisulcata, Reeve, Conch. Icon., xi., 1859, pl. xxxvi., f. 233.

Station 41.

This species is an addition to the Australian fauna. I owe the recognition of it to Mr. Stephen Pace, who kindly identified a specimen of it I collected in Middle Harbour. I have since taken it on the beach at Dudley, New South Wales.

One dead shell from 52-71 fathoms off Wata Mooli.

Family MURICIDÆ.

MUREX, *Linné.*

MUREX DAMICORNIS, sp. nov.

(Fig. 92.)

Stations 44, 49, 52.

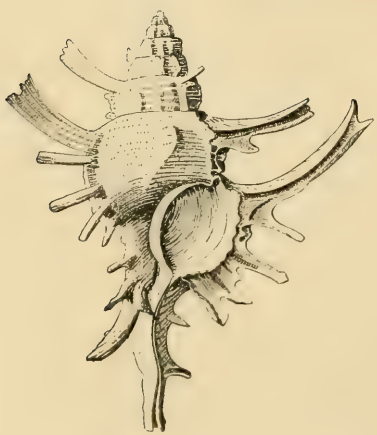

Fig. 92.

Shell fusiform, thin, spire elevated. Colour drab-grey, with a purplish tinge on the varices. Whorls six, exclusive of the protoconch, rounded, flattened above the shoulder, contracted at the suture. Sculpture: on each whorl are three varices which follow obliquely down the spire. Each varix has at the shoulder a long, simple, upcurved, broad, flattened, hollow spine, bi- or trifid at the tip; from its base springs a short spine, followed by three separate short spines. On the canal are three

similar small spines. The last whorl has one, the others two, intervariceal tubercles. The whole surface is overrun by close, spiral, squamose threads, which multiply by intercalation, and become finer on the last whorl. Protoconch smooth, elevated, two-whorled. Aperture round, posteriorly with a tubercle followed by a deep notch, outer lip advanced beyond the varix, crenulated with double denticules on the inner edge. Columella broad, arched, its edge projecting. Canal long, upcurved, slit narrow. Length, 56 mm. ; breadth (without the spines) 23 mm.

Murex cervicornis, Lamarck, was recorded by Brazier* as taken by Messrs. H. Prince and T. Haylock off Sydney Heads in 90 fathoms. The specimen referred to is now in the Australian Museum, and certainly belongs to *M. damicornis*. The only other mention of *M. cervicornis* on our coast† no doubt refers also to this species. *Murex cervicornis* ought, therefore, to be erased from the list of New South Wales Mollusca, and *M. damicornis* substituted for it.

The novelty may be classified as intermediate between *M. axicornis*, Lamarck, and *M. recticornis*, Martens.

Dredged in 49-50 fathoms off Coogee; in 19-20 fathoms in the Shoalhaven Bight; and in 63-75 fathoms off Port Kembla.

MUREX DENUDATUS, *Perry*, sp.

Triplex denudata, Perry, Conchology, 1811, pl. vii., f. 2. *Id.*, Hedley, Proc. Linn. Soc. N.S. Wales, xxvii., 1902, p. 26.

Murex palmiferus, Sowerby, Proc. Zool. Soc., 1840, p. 142. *Id.*, Reeve, Conch. Icon., iii., Murex, 1845, pl. iv., f. 20.

Station 55.

Mr. J. H. Gatliff‡ prefers to call this species *Murex abortivus*, Perry. To my mind the figure of that indicates a species of a different group of *Murex*.

One specimen from 11-15 fathoms off the Crookhaven River.

TROPHON, *Montfort.*

TROPHON LAMINATUS, *Petterd.*

Trophon laminatus, Petterd, Journ. Conch., iv., 1884, p. 136.

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* Brazier—Austr. Mus. Cat., xv., 1893, p. 54.

† Angas—Proc. Zool. Soc., 1877, p. 179.

‡ Gatliff—Viet. Nat., xix., 1902, p. 75.

Murex laminatus, Tate & May, Proc. Linn. Soc. N.S. Wales, xxvi., 1901, pp. 352, 453, pl. xxiii., f. 3.

Stations 13, 37, 49.

Judging from an apparently adult example, 7·5 mm. in length and 3·5 in breadth, this species seems to me more suitably placed in *Trophon* than in *Murex*.

A few examples occurred in 63-75 fathoms off Port Kembla; off Botany Bay in 50-52 fathoms; and one in 41-50 fathoms off Cape Three Points.

TROPHON SIMPLEX, sp. nov.

(Fig. 93.)

Stations 13, 35, 37, 49, 55, 57.

Shell small, regularly fusiform. Colour cinnamon-brown, paler at the apex and canal. Besides the two-whorled protoconch there are three adult whorls which are rather long and rounded. Suture impressed. Sculpture: on the spire are —first two then three—strong spirals which on the last whorl increase to about eight. The longitudinals commence on the antipenultimate as close, bold ribbing, imitating varices; in some individuals the radial sculpture fades away on the later whorls; in other instances, as in the shell figured, strong longitudinals cross the spirals, producing nodules at the junction. Behind the aperture a strong outstanding varix occurs. Aperture oval, neither ridged nor furrowed within, inner lip projecting a narrow rim free from the body whorl. Canal long, straight and open. Length, 8 mm.; breadth, 3·8 mm.

Fig. 93.

One or two examples each from 63-75 fathoms off Port Kembla (type); 41-50 fathoms off Cape Three Points; 50-52 fathoms off Botany Bay; 54-59 fathoms off Wata Mooli; 11-15 fathoms of Crookhaven River; and 22-38 fathoms off Port Hacking. Also taken by Mr. G. H. Halligan and myself in 100 fathoms sixteen miles east of Wollongong.

KALYDON, *Hutton*.

KALYDON PAIVÆ, *Crosse*, sp.

Trophon paivae, Crosse, Journ. de Conch, xii., 1864, p. 278, pl. xi., f. 7.

Trophon hanleyi, Angas, Proc. Zool. Soc., 1867, p. 110, pl. xiii., f. 1.

Trophon australis, Ten. Woods, Proc. Roy. Soc. Tas., 1875 (1876), p. 136.

Trophon assisi, Ten. Woods, Proc. Roy. Soc. Tas., 1876 (1877), p. 132.

Trophon squamossisima, Ten. Woods, Proc. Roy. Soc. Tas., 1878 (1879), p. 33.

Peristernia paiva, Tate, Trans. Roy. Soc. S.A., x., 1888, p. 154.

Stations 28, 33, 55.

Considerable variation occurs in this species. In the typical form the shell is solid, short and broad, angled at the shoulder by eight well developed longitudinal ribs, the aperture purple or white with a row of nodules within; it lives on rocks at low water. Another aspect of the species is a long, slender, thin shell, the longitudinal ribs evanescent, and aperture white without nodules; this one inhabits mud flats. *Trophon squamossisima* is an extreme form from deep water.

From 22 fathoms off the Manning River; 24-27 fathoms in the Newcastle Bight; and 11-15 fathoms off the Crookhaven River.

TYPHIS, *Montfort.*

TYPHIS SYRINGIANUS, sp. nov.

(Fig. 94.)

Stations 13, 27, 28, 35, 49, 57.

Shell small, rather solid, ovate. Whorls five, shelved at the shoulder. Colour pale brown. Sculpture: altogether twenty double varices, each composed of two evenly spaced elevated folds which fuse at the base, and, uniting in an arch above, project a short, backwardly bent pipe, at the shoulder. In the hollow between each double varix occurs the scar of a former aperture. Fine growth lines extend over the whole surface. Protoconch elevated, smooth, of a whorl and a half. Aperture oval, peristome continuous, produced within the varix; canal short, hardly curved. Length, 9; breadth, 5·5 mm.

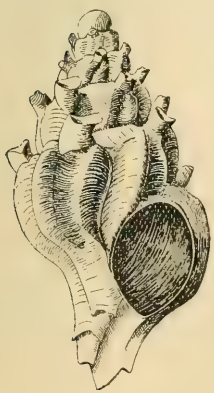

Fig. 94.

The species here described has been mistaken by Tenison Woods,* and several subsequent writers, for the South African *T. arcuatus*, Hinds. The latter is described† as five and one-half lines long, which dimension considerably exceeds the Australian shell.

* Ten. Woods—Proc. Roy. Soc. Tas., 1876 (1877), p. 132.

† Hinds—Proc. Zool. Soc., 1843, p. 19.

It appears from the figures* which Hinds gave that the Australian shell differs from *T. arcuatus* by more numerous, closer and more upright folds, shorter and straighter canal, duller colour and less prominent apex.

The literary history of this species and the next has been related in full by Brazier.†

A doubtful Australian *Typhis* is *Murex (Trophon) fruticosus*, Gould,‡ ascribed to New Holland in the original description,§ and finally placed by its author in *Typhis*.‖ Tryon includes Gould's species as a synonym of *Murex noduliferus*, Sby.¶

Dredged off Cape Three Points 41-50 fathoms (type); off the Manning River 22-23 fathoms; off Port Hacking 22-28 fathoms; off Wata Mooli 54-59 fathoms; and off Port Kembla 63-75 fathoms.

TYPHIS PHILLIPENSIS, *Watson* (emend).

Typis cleryi, Sowerby, Thes. Conch., iii., 1866, p. 320, pl. 284, f. 14 [not *Murex (Typhis) cleryi*, Petit, Revue Zool., iii., 1840, p. 327].

Typhis philippensis, Watson, Chall. Rep., Zool., xv., 1886, p. 162, pl. x., f. 4.

Station 27.

The example figured by Watson was shorn of many tubes. On the ground that the Brazilian species called *T. cleryi* by Petit had previously received a name from Broderip, Tryon proposed to resume the name *T. cleryi* as of Sowerby for the Australian species. By the modern zoological rule of once a synonym always a synonym, Sowerby's inherently defective name must be rejected.

From 22-23 fathoms off the Manning River.

PURPURA, *Bruguiere.*

PURPURA SERTATA, sp. nov.

(Figs. 95, 96.)

Stations 13, 37, 49.

Shell small, solid, biconical, profusely ornamented with lines of erect scales, spire tabulate, canal produced, sinuate. Colour: the

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* Hinds—Zool. Sulphur, ii., 1844, pl. iii., f. 1, 2.
† Brazier—Austr. Mus. Cat., xv., 1893, p. 72.
‡ Gould—U.S. Explor. Exped., xii., Moll., 1852, p. 234, pl. xvii., f. 287.
§ Gould—Proc. Boston Soc. Nat. Hist., iii, 1849, p. 143.
‖ Gould—Otia, 1862, p. 245.
¶ Tryon—Man. Conch., ii., 1880, p. 110.

scales white, the shell pale purple. Whorls three, plus a five-whorled sinusigera protoconch. Sculpture: there are seven or eight obscure longitudinal ribs, marked by the scales in perfect shells, and apparent only on worn specimens. Along the angle of the shoulder runs a line of subtubular imbricating scales, each expanding an erect hood, from under which issues the succeeding scale. Beneath are six spiral lines of much smaller scales, each connected by lamellæ, with the scales above and below. Between the suture and the shoulder are two similar lines. The protoconch is of the "sinusigera" type, with four keels on the last whorl, two of which ascend the spire; the two first whorls smooth, the others crossed obliquely by numerous delicate lamellæ which cross the keels; the aperture is thickened and reflected, a peripheral tongue intervenes between two deep bays, within which the adult sculpture develops. Length of specimen figured, 6·5 mm.; breadth, 4·5 mm. Another and worn specimen—length, 9 mm.; breadth, 4·5 mm.

Fig. 95.

Fig. 96.

Probably the largest of the series before me is still immature, and I have, therefore, refrained from describing the aperture. Though similar sculpture is described by Watson in *Murex aedonius*, by Pritchard and Gatliff in *Coralliophila wilsoni*, and prevails in *Trophon flindersi*, Ad. & Angas, it appears to distinguish the present species among *Purpura*. Had not my material included the protoconch, I should have referred the species to *Murex*, but the sinusigera apex claims for it a place in *Purpura*. I share the opinion of my friend, H. L. Kesteven, who, referring to the protoconch of *Purpura tritoniformis*, concludes that:—"Since the only three embryos of this extraordinary type that have been followed to their later stages have proved to be those of *Purpura*, such an apex may surely be taken as a guide to the generic position."* The sculpture of this sinusigera distinguishes it specifically from those already known.

Purpura is regarded as characteristic of the zone between tide marks; I do not know that it has before been noted from so deep as 100 fathoms.

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* Kesteven—Proc. Linn. Soc. N.S. Wales, xxvi., 1901, p. 537.

A few specimens occurred off Port Kembla in 63-75 fathoms; off Botany Bay in 50-52 fathoms; and one embryo off Cape Three Points in 41-50 fathoms. Mr. G. H. Halligan and I dredged one shell in 100 fathoms sixteen miles east of Wollongong.

PURPURA TRITONIFORMIS, *Blainville.*

Purpura tritoniformis, Blainville, Nouv. Ann. Mus., i., 1833, p. 221, pl. x., f. 10. *Id.*, Kesteven, Proc. Linn. N.S. Wales, xxvi., 1902, p. 533-8, pl. xxix.

Stations 52, 55, 56.

From 11-15 fathoms off the Crookhaven River; 19-20 fathoms in the Shoalhaven Bight; and 79-80 fathoms off Botany Bay.

Family TEREBRIDÆ.

TEREBRA, *Bruguiere,*

TEREBRA FICTILIS, *Hinds.*

Terebra fictilis, Hinds, Thes. Conch., i., 1844, p. 183, pl. xlv., f. 109, 110. *Id.*, Hedley, Proc. Linn. Soc. N.S. Wales, xxv., 1900, p. 509, pl. xxvi., f. 14.

Terebra assimilis, Angas, Proc. Zool. Soc., 1867, p. 111, pl. xiii., f. 8.

Station 28.

One dead specimen from 22 fathoms off the Manning River.

TEREBRA BICOLOR, *Angas.*

Terebra bicolor, Angas, Proc. Zool. Soc., 1867, p. 111, pl. xiii., f. 7.

Station 33.

A few dead shells from 24-27 fathoms at the north end of the Newcastle Bight.

Family PLEUROTOMIDÆ.

PLEUROTOMA, *Lamarck.*

PLEUROTOMA VEPRATICA, sp. nov.

(Fig. 97.)

Stations 13, 37, 49.

Shell small, thin, slender, fusiform, prickly, spire pagodiform. Colour uniform pale brown. Whorls six, plus a five-whorled

embryonic apex. Sculpture: except the prickles and ridges, the whole surface is microscopically granulated; ten sharp projecting radial ribs, interrupted by the broad anal fasciole, ascend the spire obliquely; along the periphery of each whorl runs a broad spiral shelf, beneath it are two similar but lesser spirals, the lowest of which is half buried in the suture, and above it are three rapidly and successively diminishing spirals; these radials and spirals enclose deeply sunk lozenges, at the point of intersection upwardly directed prickles arise; the anal fasciole is marked with crescentic striæ; on the base and canal are a dozen spiral threads. Apex of five whorls sharply differentiated from the adult shell, sculptured with close delicate, crenulate, radial riblets. Slit sutural, broad and deep. Aperture pyriform, narrowing gradually to the canal, lip sharp, no callus on the columella. Canal very long, open, sinuate. Length, 10 mm.; breadth, 4 mm.

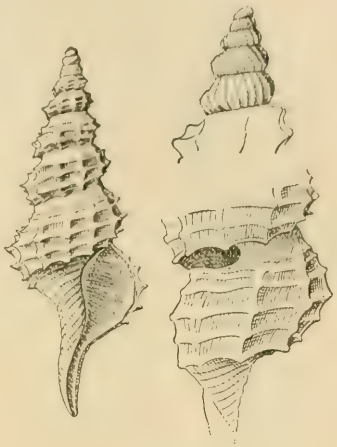

Fig. 97.

The prickly sculpture, deep sutural slit, slender recurved canal and peculiar apex distinguish this from any other Australian Pleurotomoid. Some features of it recall the American *Ancistrosyrinx*.

My drawings show a shell not quite adult, the sinus of an adult but broken specimen, and the apex of a third individual.

A few specimens were procured in 63-75 fathoms off Port Kembla; off Botany Bay in 50-52 fathoms; and one off Cape Three Points in 41-50 fathoms. Another was obtained by the Australian Museum Expedition in 1880 off Cabbage Tree Island, Port Stephens, in 24 fathoms. The species also occurs in Torres Straits.

BATHYTOMA, *Harris & Burrows.*

BATHYTOMA BICONICA, sp. nov.

(Fig. 98.)

Station 52.

Shell solid, biconical, slightly angled at the shoulder, of more than six whorls. Colour apparently flesh-tint. Sculpture:

below the shoulder the shell is furrowed by numerous fine spiral grooves, crossed by arcuate growth lines, above the furrows are broader and fewer. Aperture narrow, sinus sutural and deep, outer lip (broken in my example) appears to have curved far forward, columella angled in the centre, spreading broadly and with a small anterior plication. Length, 18 mm.; breadth, 8 mm.

Fig. 98.

Though the single available specimen is too worn and faded to afford particulars of the colour, protoconch, &c., I am induced to describe it because it adds a genus as well as a species to our fauna. In ascribing it to *Bathytoma*, I am guided by the account given by Harris.*

From 19-20 fathoms in the Shoalhaven Bight.

LEUCOSYRINX, *Dall.*

LEUCOSYRINX RECTA, sp. nov.

(Fig. 99.)

Stations 13, 35, 37, 49.

Shell pagodiform, thin, tall and narrow. The last whorl has a median cylindrical area, angled above and below. The keel along the lower angle is buried by the suture of the following whorl; that along the upper angle projects more and ascends the spire to the protoconch, where it suddenly ceases. Above the upper keel the whorl slopes to the suture, below the lower the base is concavely excavated. Colour pale yellow. Whorls four, plus the protoconch, wound obliquely. Sculpture: the topmost whorl is undulated by about sixteen broad radial ribs, which disappear on the next whorl. Fine and coarse spiral threads alternate over the whole surface, and are crossed by fine growth lines. Protoconch exsert, white, smooth, two-whorled. Aperture broad, lip simple, no apparent sinus, canal short, open, straight. Length, 6 mm.; breadth, 2·5 mm.

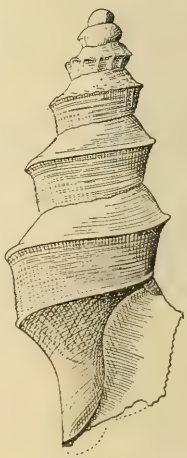

Fig. 99.

Pleurotoma (Surcula) staminea, Watson,† appears a near ally of this species.

* Harris—Brit. Mus. Cat. Tert. Moll. Austr., 1897, p. 48.

† Watson—Chall. Rep., Zool., xv., 1886, p. 286, pl. xx., f. 3.

A few specimens from 41-50 fathoms off Cape Three Points; from 22-36 fathoms off Port Hacking; from 50-52 fathoms off Botany Bay; and from 63-75 fathoms off Port Kembla.

DRILLIA, *Gray.*

DRILLIA DILECTA, sp. nov.

(Fig. 100.)

Stations 13, 37, 49, 57.

Shell small, solid, narrowly fusiform, tricarinate, shoulder sloping, base contracted, canal short, straight. Whorls five, plus a smooth, elevated, two-whorled protoconch. Colour pale yellow. Sculpture: on the body whorl are three peripheral spiral keels, on the spire two such keels on each whorl; on the base are numerous, and on the shoulder three or four, revolving threads. The interstices of the spirals are occupied by the broken lengths of close, fine, longitudinal, raised threads, which united describe a double curve. Aperture simple, presumably undeveloped in the examples to hand. Length, 7 mm.; breadth, 2·5 mm.

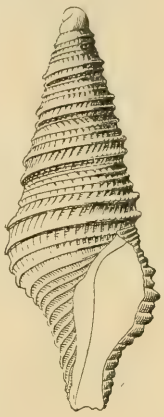

Fig. 100.

This species is in general appearance most like *D. tricarinata*, Ten. Woods, from which its longitudinal sculpture easily divides it That feature recalls *Pleurotoma violacea*, Hinds, a larger and proportionately broader shell.

A few specimens were taken off Port Kembla in 63-75 fathoms; off Cape Three Points in 41-50 fathoms; 50-52 fathoms off Botany Bay; and 54-59 fathoms off Wata Mooli. My type is chosen from a better example dredged off Cabbage Tree Island, Port Stephens, in 24 fathoms.

DRILLIA NENIA, sp. nov.

(Fig. 101.)

Stations 13, 49, 57.

Shell small, narrow, angled at the shoulder, glossy. Whorls five, plus a smooth, tilted, globose, two-whorled protoconch. Colour pure white. Sculpture: curved, stout shouldered ribs, twelve on the last whorl, mount the spire obliquely, become obsolete anteriorly, and terminate abruptly at each anal

fasciole ; the whole shell covered by fine, close, microscopic growth striæ. Base contracted. Canal short. Aperture narrow, anal notch deep, with raised, subtubular margin, columella slightly arched, overlaid by a thick callus sheet. Length, 6·6 mm. ; breadth, 2·5 mm.

Fig. 101.

A few examples were taken off Port Kembla in 63-75 fathoms; off Cape Three Points in 41-50 fathoms; off Wata Mooli in 54-59 fathoms; and off the Manning River in 22 fathoms. A better specimen selected for illustration was procured in 24 fathoms off Cabbage Tree Island, Port Stephens.

DRILLIA COXI, Angas.

Drillia coxi, Angas, Proc. Zool. Soc., 1867, p. 113, pl. xiii., f. 15.

Station 28.

Tryon* has united this to *D. sinensis*, Hinds, but the feature of "sutura granosa-carinata" proper to *D. sinensis* is absent from *D. coxi*. The original description was drawn up from small and faded shells. When fresh the species is buff, sprinkled with chocolate; one example in the Australian Museum attains twelve whorls in a length of 33 mm.

From 28 fathoms off the Manning River.

DRILLIA WOODSI, *Beddome*.

Drillia woodsi, Beddome, Proc. Roy. Soc. Tas., 1882 (1883), p. 167. *Id.*, Tate & May, Proc. Linn. Soc. N.S. Wales, xxvi., 1901, p. 368.

Drillia howitti, Pritchard & Gatliff, Proc. Roy. Soc. Vict., xii., 1899, p. 101, pl. 8, f. 2. *Id.*, Hedley, Proc. Linn. Soc. N.S. Wales, xxv., 1891, p. 722.

Station 28, 37.

One specimen from 50-52 fathoms off Botany Bay; and two from 22 fathoms off the Manning River. Previously taken off the Broughton Islands, Port Stephens, in 24 fathoms.

DRILLIA SPADIX, *Watson*, sp.

Pleurotoma (Drillia) spadix, Watson, Chall. Rep., Zool., xv., 1886, p. 310, pl. xxvi., f. 6.

Station 49.

One specimen from 63-75 fathoms off Port Kembla.

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* Tryon—Man. Conch., vi., 1884, p. 201.

Fig. 102.

DRILLIA PROSUAVIS, nom. mut.

Pleurotoma (Drillia) suavis, Smith, Ann. Mag. Nat. Hist., (6), ii., 1888, p. 305. [not *Drillia suavis*, Hervier, Journ. de Conch., xliii., 1895, p. 141.]

(Fig. 102.)

Section 13.

The "Thetis" example was procured in the type locality. I have identified the species by an excellent drawing of the type in the British Museum made by Mr. J. Green, and kindly forwarded by Mr. E. R. Sykes.

Fig. 103.

Off Cape Three Points in 41-50 fathoms. A specimen is in the collection from 24 fathoms off Broughton Island.

DRILLIA MULTILIRATA, *Smith*, sp.

Pleurotoma (Drillia) multilirata, Smith, Ann. Mag. Nat. Hist., (4), xix., 1877, p. 496.

(Fig. 103.)

Though not included in the "Thetis" collection, the species is here introduced for the sake of publishing the accompanying figure of the type from the pencil of Mr. J. Green. The habitat attached to the original description is "?Port Jackson," but it has not been recognised here.

DRILLIA TRICARINATA, *Ten. Woods.*

Drillia tricarinata, Ten. Woods, Proc. Linn. Soc. N.S. Wales, ii., 1878, p. 265. *Id.*, Hedley, Rec. Austr. Mus., iv., 1891, p. 23, f. 3.

(Fig. 104.)

Stations 13, 22, 37, 49, 57.

The shells procured by the "Thetis" show the type to have been founded on an immature shell. The original description may be amended by the following particulars. Whorls five,

with a two-whorled protoconch. Surface entirely microscopically granulated. Behind the aperture is a gradually swollen varix, in which the rounded sinus is obliquely excavated. The entrance of the sinus is narrowed by a thick parietal pad of callus and the thin incurved corner of the outer lip. On the columella is spread a thick sheet of callus. Length, 9 mm.; breadth, 3·75 mm.

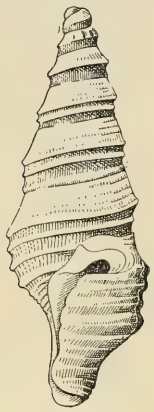

Fig. 104.

A few specimens from off Port Kembla in 63-75 fathoms; off Cape Three Points in 41-50 fathoms; off Wata Mooli in 54-59 fathoms; off Botany Bay in 50-52 fathoms; and off the Manning River in 22 fathoms. Also collected previously off Cabbage Tree Island, Port Stephens, in 24 fathoms.

DAPHNELLA, *Hinds.*

DAPHNELLA VESTALIS, sp. nov.

(Fig. 105.)

Stations 13, 37.

Shell ovate, rather solid, angled at the shoulder, constricted at the base. Colour white. Whorls five, plus a two-whorled protoconch. Sculpture: rounded spiral cords, the longitudinal series amounting to about twenty on the last whorl and eight on the penultimate, crossing and knotting a spiral series amounting to about thirty-seven on the penultimate; the longitudinals vanish at the base and are effaced behind the aperture. Suture channelled. Protoconch smooth. Aperture wide, lip simple and without sinus. Length, 8 mm.; breadth, 3·75 mm.

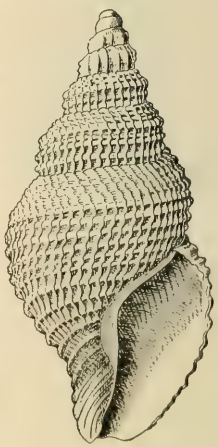

Fig. 105.

This species is nearest to *D. hayesiana*, Angas,* from which it may be distinguished by having no sinus, a denser ornament, and by being smaller and proportionately broader. *D. hayesiana* is compared by its author to *Clathurella reticosa*, Ad. & Angas,† an alleged Australian species, probably founded on an imported British specimen of *Clathurella purpurea*, Montagu.

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* Angas—Proc. Zool. Soc., 1871, p. 17, pl. i., f. 17

† Adams & Angas—Proc. Zool. Soc., 1863, p. 420.

Fig. 102.

DRILLIA PROSUAVIS, nom. mut.

Pleurotoma (Drillia) suavis, Smith, Ann. Mag. Nat. Hist., (6), ii., 1888, p. 305. [not *Drillia suavis*, Hervier, Journ. de Conch., xliii., 1895, p. 141.]

(Fig. 102.)

Station 13.

The "Thetis" example was procured in the type locality. I have identified the species by an excellent drawing of the type in the British Museum made by Mr. J. Green, and kindly forwarded by Mr. E. R. Sykes.

Off Cape Three Points in 41-50 fathoms. A specimen is in the collection from 24 fathoms off Broughton Island.

Fig. 103.

DRILLIA MULTILIRATA, *Smith*, sp.

Pleurotoma (Drillia) multilirata, Smith, Ann. Mag. Nat. Hist., (4), xix., 1877, p. 496.

(Fig. 103.)

Though not included in the "Thetis" collection, the species is here introduced for the sake of publishing the accompanying figure of the type from the pencil of Mr. J. Green. The habitat attached to the original description is "?Port Jackson," but it has not been recognised here.

DRILLIA TRICARINATA, *Ten. Woods.*

Drillia tricarinata, Ten. Woods, Proc. Linn. Soc. N.S. Wales, ii., 1878, p. 265. *Id.*, Hedley, Rec. Austr. Mus., iv., 1891, p. 23, f. 3.

(Fig. 104.)

Stations 13, 22, 37, 49, 57.

The shells procured by the "Thetis" show the type to have been founded on an immature shell. The original description may be amended by the following particulars. Whorls five,

with a two-whorled protoconch. Surface entirely microscopically granulated. Behind the aperture is a gradually swollen varix, in which the rounded sinus is obliquely excavated. The entrance of the sinus is narrowed by a thick parietal pad of callus and the thin incurved corner of the outer lip. On the columella is spread a thick sheet of callus. Length, 9 mm. ; breadth, 3·75 mm.

Fig. 104.

A few specimens from off Port Kembla in 63-75 fathoms; off Cape Three Points in 41-50 fathoms; off Wata Mooli in 54-59 fathoms; off Botany Bay in 50-52 fathoms; and off the Manning River in 22 fathoms. Also collected previously off Cabbage Tree Island, Port Stephens, in 24 fathoms.

DAPHNELLA, *Hinds.*

DAPHNELLA VESTALIS, sp. nov.

(Fig. 105.)

Stations 13, 37.

Shell ovate, rather solid, angled at the shoulder, constricted at the base. Colour white. Whorls five, plus a two-whorled protoconch. Sculpture : rounded spiral cords, the longitudinal series amounting to about twenty on the last whorl and eight on the penultimate, crossing and knotting a spiral series amounting to about thirty-seven on the penultimate ; the longitudinals vanish at the base and are effaced behind the aperture. Suture channelled. Protoconch smooth. Aperture wide, lip simple and without sinus. Length, 8 mm. ; breadth, 3·75 mm.

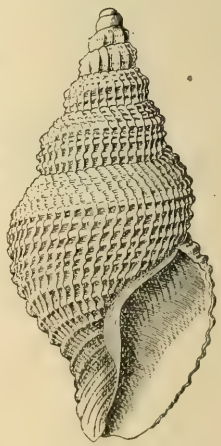

Fig. 105.

This species is nearest to *D. hayesiana*, Angas,* from which it may be distinguished by having no sinus, a denser ornament, and by being smaller and proportionately broader. *D. hayesiana* is compared by its author to *Clathurella reticosa*, Ad. & Angas,† an alleged Australian species, probably founded on an imported British specimen of *Clathurella purpurea*, Montagu.

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* Angas—Proc. Zool. Soc., 1871, p. 17, pl. i., f. 17.

† Adams & Angas—Proc. Zool. Soc., 1863, p. 420.

Taken by the "Thetis" off Cape Three Points in 41-50 fathoms; and off Botany Bay in 50-52 fathoms; previously off Cabbage Tree Island, Port Stephens, in 24 fathoms.

DAPHNELLA BRENCHLEYI, *Angas*, sp.

Clathurella brenchleyi, Angas, Proc. Zool. Soc., 1877, p. 37, pl. v., f. 12.

(Fig. 106.)

Station 13.

A few examples taken by the "Thetis" differ from typical specimens from Port Stephens by being paler, with slighter longitudinal sculpture. They are also smaller, measuring 12 mm. in length and 4·5 mm. in breadth.

Owing possibly to worn material, the sculpture is not well described in the original diagnosis. I find the entire shell to be girt with flat topped spiral ridges, parted by deep, sharp grooves, about twenty-seven of such are borne by the last, and about twelve by the penultimate, whorls—including three or four on the fasciole. The surface of the elevation is cut into oblique, close-set gemmules. These are repeated within the deep interstice by a minute gemmule thread. The eight whorls counted by Angas include a two-whorled, finely punctate, grooved protoconch.

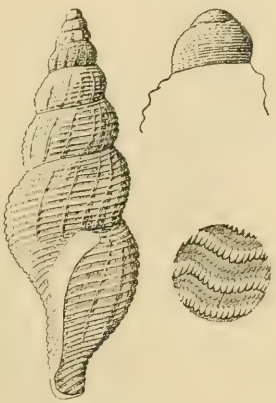

Fig. 106.

From 41-50 fathoms off Cape Three Points.

DAPHNELLA ANGASI, *Hedley*, nom. mut.

Clathurella sculptilis, Angas, Proc. Zool. Soc., 1871, p. 17, pl. i., f. 19, [not *Daphnella sculptilis* (Tate), Harris, Brit. Mus. Cat. Tert. Moll. Austr., 1897, p. 61].

Station 13.

A single specimen from 41-50 fathoms off Cape Three Points.

DAPHNELLA BRAZIERI, *Angas*, sp.

Clathurella brazieri, Angas, Proc. Zool. Soc., 1871, p. 18, pl. i., f. 22.

(Fig. 107.)

Stations 13, 28, 35, 37, 49.

The figure and description of this species are not good. Indeed, without the aid of a specimen identified by Brazier, I should have failed to recognise the species. It seems well, therefore, to introduce here a figure and redescription derived from a specimen dredged off Port Kembla.

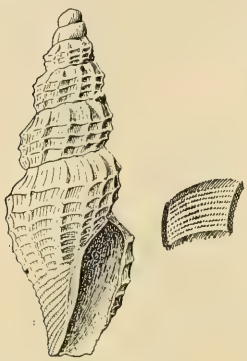

Fig. 107.

Shell elongate, fusiform, thin, angled at the shoulders of each whorl. Colour dull white. Whorls four and a half, plus a two-whorled protoconch. Sculpture : wave-like longitudinal ribs, amounting to thirteen on the last whorl, curve across the sutural shelf, are sharply angled, and project at the shoulder, thence descend perpendicularly to the base, where they disappear. These are over-ridden by spiral cords, on the upper whorls three, on the last twenty, crowded below and widely spaced above. The meshes of the major sculpture are occupied by microscopical, dense, spiral threads, ornamented by minute gemmules, which give a dusty appearance to the shell. Protoconch exsert, of two whorls, smooth and glossy. Aperture wide, lip simple, straight; sinus broad and shallow, canal abbreviated. Length, 7 mm.; breadth, 3·5 mm.

Off Cape Three Points in 41-50 fathoms; off the Manning River in 22 fathoms; off Port Hacking in 22-38 fathoms; off Botany Bay in 50-52 fathoms; and off Port Kembla in 63-75 fathoms.

MANGELIA, *Risso.*

MANGELIA TENUILIRATA, *Angas*, sp.

Clathurella tenuilirata, Angas, Proc. Zool. Soc., 1871, p. 17, pl. i., f. 18.

Stations 13, 49.

From 41-50 fathoms off Cape Three Points; and from 63-75 fathoms off Port Kembla.

MANGELIA GRANULOSSISIMA, *Ten. Woods*, sp.

Clathurella granulossisima, Ten. Woods, Proc. Roy. Soc. Tas., 1878 (1879), p. 37. *Id.*, Tate & May, Proc. Linn. Soc. N.S. Wales, xxvi., 1901, p. 370, pl. xxiv., f. 34.

Stations 28, 49.

The "Thetis" shells are larger, and with less developed ribs than Tasmanian shells.

From 22 fathoms off the Manning River; and from 63-75 fathoms off Port Kembla.

Class OPHISTHOBRANCHIA.

Family ACTÆONIDÆ.

ACTÆON, *Montfort.*

ACTÆON AUSTRINUS, *Watson.*

Actæon austrinus, Watson, Journ. Linn. Soc., xvii., 1883, p. 286. *Id.*, Chall. Rep., Zool., xv., 1886, p. 628, pl. xlvii., f. 2.

Stations 13, 37.

From my recollection of the type I should think that *Fossarus bulimoides**, Ten. Woods, represents the young of this species.

Pritchard and Gatliff suppose that this species is identical with *Turbonilla casta*, A. Ad.† I venture to suggest that in the absence of specimens a superficial resemblance has misled them.

Two specimens from 41-50 fathoms off Cape Three Points; and one from 50-52 fathoms off Botany Bay.

Family TORNATINIDÆ.

TORNATINA, *A. Adams.*

TORNATINA EXSERTA, sp. nov.

(Fig. 108.)

Station 28.

Shell small, narrow, subcylindrical; spire drawn out, last whorl slightly medially constricted. Colour uniform milk-white.

* Ten. Woods—Proc. Roy. Soc. Tas., 1876 (1877), p. 148.

† Pritchard & Gatliff—Proc. Roy. Soc. Vic., xv., 1903, p. 211.

Whorls four, plus the protoconch. Suture channelled. Sculpture: dense microscopic spiral striæ, decussated by obscure growth lines; to the unaided eye the shell is smooth and glossy. Outer lip inserted far back, its edge arcuate. Inner lip spreading, a callus on the body whorl, columella plication weak. Length, 6·5 mm.; breadth, 2 mm.

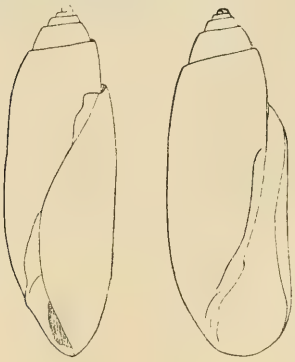

Fig. 108.

This species apparently is nearest to *T. hofmani*, Angas,* a species I have not yet identified. As the figure of that differs in its proportions from the measurements given in the text, it is probably inaccurate. If it is at all natural, the two species are distinct, the novelty being a narrower shell, with a longer spire.

One specimen from 22 fathoms off the Manning River.

VOLVULA, *A. Adams.*

VOLVULA ROSTRATA, *A. Adams*, sp.

Fig. 109.

Bulla rostrata, A. Adams, Thes. Conch., ii., 1850, p. 596, pl. cxxv., f. 154.

(Fig. 109.)

Station 49.

Specimens from New South Wales are always smaller than southern examples. When the species is fully grown it is less rostrate at the summit than in juvenile stages. For comparison with the following species, I add an outline sketch of a South Australian example, 7 mm. long, determined and sent by the late Prof. R. Tate.

Two shells from 63-75 fathoms off Port Kembla. Mrs. H. Forde has gathered this species at Pambula.

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* Angas—Proc. Zool. Soc., 1877, p. 40, pl. v., f. 20.

VOLVULA TRAGULA, sp. nov.

(Fig. 110.)

Station 49.

Shell small, thin, semiopaque, oblong-acuminate. Colour milk-white. Sculpture: everywhere finely, spirally grooved; medially the grooves are almost effaced, posteriorly about half-a-dozen are deeply incised. Faint longitudinal growth lines are perceptible. The aperture is as long as the shell, posteriorly it narrows to a canal, anteriorly is broad and effuse. The inner lip terminates in a spike posteriorly. The columella forms at the base a broad auricular lobe, with a thickened edge. Neither umbilicus nor umbilical furrow are present. Length, 4 mm.; breadth, 1·65 mm.

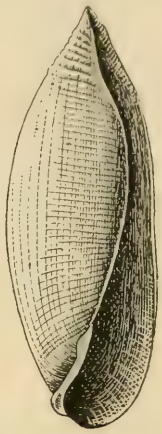

Fig. 110.

The present is readily distinguished from other Australian *Volvulæ* by the sharp point of the posterior end.

Two shells from 63-75 fathoms off Port Kembla. There is a series in the Australian Museum dredged off Watson's Bay. I obtained it in 1901 in 15 fathoms off South Palm Island, Queensland, which gives the species a range of sixteen degrees of latitude.

Family SCAPHANDRIDÆ.

CYLICHNA, *Lovén.*

CYLICHNA THETIDIS, sp. nov.

(Fig. 111.)

Stations 28, 49.

Shell narrow, elongated, cylindrical, thin and glossy. Colour white. Sculpture: growth lines hardly perceptible, encircled by fine, close, incised lines; almost effaced medially, and wider spaced posteriorly. The crown concave, with a narrow axial perforation, partly roofed by a callus arch. Aperture as long as the shell, narrow above, expanded and effuse below; lined

on the inner side by a sheet of callus ragged at the edge. Columella thickened, with a prominent fold, behind which a furrow runs up under the lip callus. Length, 11·5 mm.; breadth, 4·5 mm.

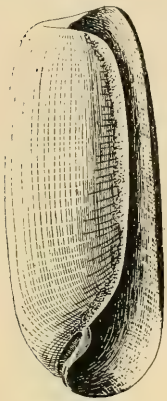

Fig. 111.

The narrowly perforate summit easily distinguishes this from *C. arachis*, Q. & G., the only Australian shell likely to be taken for it.

The Chinese *C. involuta*, A. Ad.,* appears to resemble it more.

The "Thetis" procured this off the Manning River in 22 fathoms; and in 63-75 fathoms off Port Kembla. I have taken it on the beach in Middle Harbour.

CYLICHNA PROTUMIDA, sp. nov.

(Fig. 112.)

Stations 13, 35, 37, 49, 57.

Shell narrow, long in the waist, inflated rather suddenly at the anterior third, rounded anteriorly, obliquely truncated at the vertex. Colour pale yellow. Sculpture: faint growth lines are cut at right angles by fine, sharp, incised, spiral lines, which are more or less obliterated medially, but distinct posteriorly. Aperture the full length of the shell, posteriorly enlarged, and leaning in towards the axis, medially constricted to a slit, and posteriorly opening in a pear-shaped expansion. The body whorl is overlaid by a sheet of callus. Columella slightly curved, broad inner margin subdentate, outer reflexed. Vertex pierced by a narrow, deep, axial perforation. Length, 5·4 mm.; breadth, 2·3 mm.

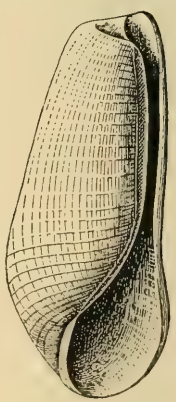

Fig. 112.

This is the species recorded† from Watson's Bay by Brazier as *Cylichna pyramidata*, A. Ad.‡

The "Thetis" took a few specimens off Cape Three Points in 41-50 fathoms; off Wata Mooli in 54-59 fathoms; off Botany Bay

* A. Adams—Thes. Conch., ii., 1850, p. 595, pl. cxxv., f. 149.
† Brazier—Rec. Austr. Mus., i., 1890, p. 85.
‡ A. Adams—Thes. Conch., ii., 1850, p. 595, pl. cxxv., f. 149.

in 50-52 fathoms; off Port Hacking in 22-38 fathoms; and off Port Kembla in 63-75 fathoms. On the occasion of the "Challenger" entertainment, it was received by Brazier from 75 fathoms five miles east of Sydney Heads.

CYLICHNA ARACHIS, *Quoy & Gaimard*, sp.

Bulla arachis, Quoy & Gaimard, Voy. Astrolabe, Zool., ii., 1835, p. 361, pl. 26, f. 28-30.

Cylichna arachis, Pilsbry, Man. Conch., xv., 1893, p. 318, pl. 27, ff. 92, 93.

Stations 13, 49, 57.

Numerous specimens from 41-50 fathoms off Cape Three Points; a few from 54-57 fathoms off Wata Mooli; and one from 63-75 fathoms off Port Kembla.

Family HYDATINIDÆ.

APLUSTRUM, *Schumacher.*

APLUSTRUM BRAZIERI, *Angas*, sp.

Diaphana brazieri, Angas, Proc. Zool. Soc., 1877, p. 175, pl. xxvi., f. 20 (bad).

Aplustrum brazieri, Hedley, Proc. Linn. Soc. N.S. Wales, xxvii., 1902, p. 16, pl. iii., f. 36.

Station 13.

Several specimens from off Cape Three Points in 41-50 fathoms.

Family RINGICULIDÆ.

PUGNUS, *Hedley.*

PUGNUS PARVUS, *Hedley.*

Pugnus parvus, Hedley, Rec. Austr. Mus., ii., 1896, p. 106, pl. xxiii., f. i. *Id.*, Pilsbry, Man. Conch., xvi., 1896, p. 234, pl. 74, f. 7.

Station 13.

Several specimens were obtained off Cape Three Points in 41-50 fathoms.

Family PHILINIDÆ.

PHILINE, *Ascanius.*

PHILINE TERES, sp. nov.

(Fig. 113.)

Stations 13, 49.

Shell small, thin, globose, much inflated. Whorls two, last

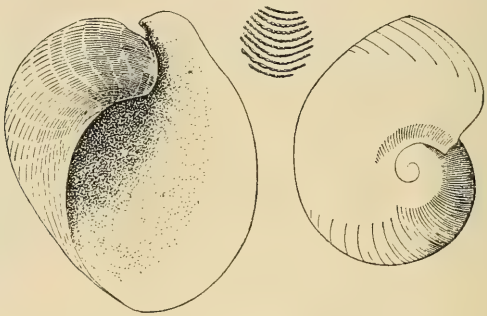

Fig. 113.

large, rather oblique, contracted below the vertex. Spire concave. Sculpture: microscopic, dense, spiral strings of oval beads, interrupted by growth lines. Colour white. Interior smooth, polished. Columella edge curled, behind it an umbilical groove. Inner lip broadly arched below, sharply recurved above. Outer lip above detached from the whorl and reaching forward. Length, 3 mm.; breadth, 2·5 mm.

The small size, rotundity, curvature of the inner lip and free lobe of the outer one are features which distinguish this species.

A few specimens from off Cape Three Points in 41-50 fathoms; and from off Port Kembla in 63-75 fathoms.

Class PTEROPODA.

Family LIMACINIDÆ.

LIMACINA, *Cuvier.*

LIMACINA INFLATA, *D'Orbigny*, sp.

Atlanta inflata, D'Orbigny, Voy. Amer. Mérid., v., 1836, p. 174, pl. xii., f. 16, 17.

Limacina inflata, Pelseneer, Chall. Rep., Zool., xxiii., 1888, p. 17.

Stations 13, 49.

Abundant off Cape Three Points in 41-50 fathoms; and off Port Kembla in 63-75 fathoms.

LIMACINA TROCHIFORMIS, *D'Orbigny*, sp.

Atlanta trochiformis, D'Orbigny, Voy. Amer. Mérid., v , 1836, p. 177, pl. xii., ff. 29-31.

Limacina trochiformis, Pelseneer, *loc. cit.*, p. 29.

Station 49.

Two specimens from 63-75 fathoms off Port Kembla.

LIMACINA BULIMOIDES, *D'Orbigny*, sp.

Atlanta bulimoides, D'Orbigny, Voy. Amer. Mérid., v., 1836, p. 179, pl. xii., ff. 36-38.

Limacina bulimoides, Pelseneer, *loc. cit.*, p. 30.

Station 13.

From 41-51 fathoms off Cape Three Points.

Family CAVOLINIIDÆ.

CLIO, *Linné.*

CLIO VIRGULA, *Rang*, sp.

Creseis virgula, Rang, Ann. Sci. Nat., (1), xiii., 1828, p. 316, pl. xvii., f. 2.

Clio virgula, Pelseneer, *loc. cit.*, p. 48.

Stations 13, 49.

Several specimens from 41-50 fathoms off Cape Three Points; and from 63-75 fathoms off Port Kembla.

CLIO ACICULA, *Rang*, sp.

Creseis acicula, Rang, Ann. Sci. Nat., (1), xiii., 1828, p. 318, pl. xvii., f. 6.

Clio acicula, Pelseneer, *loc. cit.*, p. 51.

Stations 13, 57.

A specimen from 41-50 fathoms off Cape Three Points; and another from 54-59 fathoms off Wata Mooli.

CLIO STRIATA, *Rang*, sp.

Creseis striata, Rang, Ann. Sci. Nat., (1), xiii., 1828, p. 315. pl. xv., f. 7.

Clio striata, Pelseneer, *loc. cit.*, p. 54.

Station 13.

One specimen from 41-50 fathoms off Cape Three Points.

CLIO SUBULA, *Quoy & Gaimard*, sp.

Cleodora subula, Quoy & Gaimard, Ann. Sci. Nat. (1), x., 1827, p. 233, pl. viii. D, ff. 1-3.

Clio subula, Pelseneer, *loc. cit*, p. 57.

Stations 13, 49.

Several specimens from 41-50 fathoms off Cape Three Points; and from 63-75 fathoms off Port Kembla.

CLIO PYRAMIDATA, *Linné.*

Clio pyramidata, Linné, Syst. Nat., Ed. xii., 1767, p. 1094. *Id.*, Pelseneer, *loc. cit.*, p. 63.

Stations 13, 49.

Several specimens from 41-50 fathoms off Cape Three Points; and from 63-75 fathoms off Port Kembla.

CAVOLINIA, *Abildgaard.*

CAVOLINIA TRISPINOSA, *Lesueur*, sp.

Hyalaea trispinosa, Lesueur, Dict. Sci. Nat., xxii., 1821, p. 82.

Cavolinia trispinosa, Pelseneer, *loc. cit.*, p. 76.

Station 13.

One example from 41-50 fathoms off Cape Three Points.

CAVOLINIA LONGIROSTRIS, *Lesueur*, sp.

Hyalaea longirostris, Lesueur, Dict. Sci. Nat., xxii., 1821, p. 81.
Cavolinia longirostris, Pelseneer, *loc. cit.*, p. 79.

Stations 13, 49.

Several specimens from 41-50 fathoms off Cape Three Points; and from 63-75 fathoms off Port Kembla.

Class NUDIBRANCHIATA.

Family ÆOLIDIIDÆ.

GLAUCUS, *Forster*.

GLAUCUS ATLANTICUS, *Forster*.

Glaucus atlanticus, Forster, Voy. Resolution, i., 1777, p. 49. *Id.*, Bergh, Chall. Rep., Zool., x., 1884, p. 16. *Id.*, Hedley, Proc. Linn. Soc. N.S. Wales, (2), vi., 1891 (1892), p. 576.

Station 40.

Floating on the surface three miles off Wata Mooli.

Class HETEROPODA.

Family ATLANTIDÆ.

ATLANTA, *Lesueur*.

ATLANTA TURRICULATA, *D'Orbigny*.

Atlanta turriculata, D'Orbigny, Voy. Amer. Mérid. v., 1836, p. 173, pl. xx., ff. 5, 11. *Id.*, Smith, Chall. Rep., Zool., xxiii., 1888, p. 40.

Stations 13, 49.

A few specimens from 41-50 fathoms off Cape Three Points; and from 63-75 fathoms off Port Kembla.

ATLANTA ROSEA, *Eydoux & Souleyet.*

Atlanta rosea, Eydoux & Souleyet, Voy. Bonite, Zool., ii., 1852, p. 377, pl. xix., ff. 16-20.

Stations 13, 49.

A few examples from 41-50 fathoms off Cape Three Points; and from 63-75 fathoms off Port Kembla.

ATLANTA INFLATA, *Eydoux & Souleyet.*

Atlanta inflata, Eydoux & Souleyet, Voy. Bonite, Zool., ii., 1852, p. 378, pl. xix., ff. 21-28.

Station 49.

Two shells from 63-75 fathoms off Port Kembla.

Family PTEROTRACHÆIDÆ.

FIROLOIDA, *Lesueur.*

FIROLOIDA DESMARESTI, *Lesueur.*

Firoloida desmarestia, Lesueur, Journ. Acad. Nat. Sci. Phil., i., 1817, p. 39, pl. ii., f. 1. *Id.*, Smith, Chall. Rep., Zool., xxiii., 1888, p. 22.

Station 58.

Two specimens from the surface two miles off Wata Mooli.

12.009

AUSTRALIAN MUSEUM, SYDNEY.

MEMOIR IV.

SCIENTIFIC RESULTS

OF THE

TRAWLING EXPEDITION

OF

H.M.C.S. "THETIS"

OFF THE COAST OF NEW SOUTH WALES,

IN

FEBRUARY AND MARCH, 1898.

PART 7.—Published 12th February, 1904.

PUBLISHED BY ORDER OF THE TRUSTEES.

R. ETHERIDGE, Junr., J.P., Curator.

SYDNEY, 1904.

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JUL 25 1904

CRUSTACEA.

PART IV.

By THOMAS WHITELEGGE.

Zoologist, Australian Museum.

ISOPODA.

Part III.

CRUSTACEA.

PART IV.

By Thomas Whitelegge,

Zoologist, Australian Museum.

ISOPODA.

Part III.

In the following pages the remaining portion of the "Thetis" Isopoda is dealt with, including six members of the family Arcturidæ, five of which are described as new species; these are as follows:—

Arcturus simplicissimus.
,, *dentatus.*
,, *alcicornis.*
,, *nodosus.*
,, *serrulatus.*

The sixth species (*Arcturus oculatus*, Beddard) is new to the fauna of New South Wales, as the types were obtained by H.M. Ship "Challenger," off the entrance to Port Phillip, Victoria, at a depth of 33 fathoms.

The collection includes many other interesting members of the Suborder Isopoda, but these are unfortunately too imperfect to allow of description. In working out the material I have been seriously impeded by the paucity, imperfection, and extreme brittleness of the specimens; the latter feature I attribute to the action of the formaline used in their preservation, which appears to have affected the calcareous skeleton and rendered those parts brittle, whilst on the other hand the connecting tissues of the joints were hardened to such an extent that proper seriate dissection was extremely difficult.

While preparing this paper I have had occasion to overhaul the bottles containing the remainder of the "Thetis" Crustacea. I found that all the examples which had been left in the original formaline solution had seriously deteriorated; as far as their hard calcareous parts were concerned, they were rendered soft and like newly moulted crabs. Specimens that were removed from formaline to spirits, immediately after being preserved, were found in good condition.

Family ARCTURIDÆ.

ARCTURUS, *Latreille.*

Many of the species of the genus *Arcturus* are very similar in bodily contour and armature; the various appendages appear to afford the best characters whereby the species may be distinguished, and in this respect full use has been made of the relative length of the body segments, joints of the antennæ, and of the legs. A glance at the text and the accompanying figures will serve to show the value of the variation in the comparative length of joints of the larger limbs.

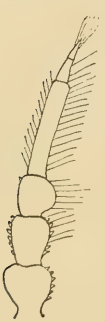
The position, number and character of the denticles or spines are also of importance. In some species the armature consists of a series of serrations; in others, of distinct spines, generally fixed, but occasionally mobile, especially near the extremities.

ARCTURUS SIMPLICISSIMUS, sp. nov.

(Figs. 114*a-c.*)

Station 57.

Adult male:—Body short, straight, and apparently without the usual power of flexure between the fourth and fifth segments of the peraeon. The superior surface is covered with a series of tubercles and ridges; the whole body, as well as the basal joints of the antennæ and legs, is more or less granulose; some of the granules are subspiniform. The cephalon bears four short, broadly conical submedian spines—two on the frontal margin and two in a transverse line with the hinder border of the eyes. The segments of the peraeon bear a pair of low submedian tubercles, and also a lateral pair which tend to form longitudinal ridges. The segments of the pleon exhibit a few low tubercles on each side of the mesial line.



Second antennæ. Fig. 114*a*.

The caudal shield has a pair of tubercles situated in the middle of the distance between its insertion and the extremity.

The first and second segments of the peraeon are short and subequal in length; the two combined are a little longer than the cephalon; the third and fourth segments are equal in length; the fourth is slightly longer than the cephalon.

Eyes large, dark brown, prominent.

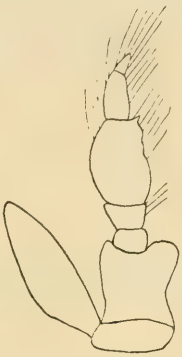
Inner antennæ very short, about equal in length to the first joints of the outer; first joint one-third longer than broad; second equal to the first, but much narrower; third joint about

equal in length to the width of the second; fourth slender, tapering, and nearly twice as long as the third.

Outer antennæ short, not equal to the length of the cephalon and the three succeeding segments of the peræon; first and second joints subequal, as broad or broader than long; third joint as long as the second, but narrower; fourth joint slender, nearly equal in length to the first and second combined; fifth joint twice as long as broad; sixth tapering to a point, and a little longer than broad. The inferior borders of the second to fourth joints are fringed with long setæ.

Mandibles stout, angularly bent above the middle, with a well defined molar tubercle, spine row, and a tridentate cutting edge.

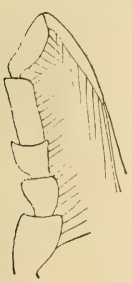
The maxillipedes have a large lanceolate epipod; the palp is five-jointed; the first two are broader than long; the third is subovate, and bears a small spinule on its inner distal angle; fourth joint twice as long as broad; fifth minute and conical in shape.



Maxillipede.
Fig. 114*b*.

First pair of legs short, stout; the second joint is twice as long as broad; third joint longer than broad and apically dilated; fourth joint nearly twice as broad as long; fifth as broad as long, increasing in diameter to the summit; sixth joint oblong, three times as long as broad; seventh joint much shorter than the sixth, slightly curved and tapering to an acute point.

Second joint of the second pair of legs one-fourth longer than broad; the third and fourth are equal, and as long as broad; the fifth and sixth are equal and nearly twice the length of the third; the upper border of the sixth joint is straight and the lower evenly curved; seventh joint slender, equal in length to the second, third, and fourth combined.



Second leg.
Fig. 114*c*.

The inferior borders of the whole of the joints are sparsely setose; the setæ on the sixth and seventh joints are longer and stouter than those on the preceding joints.

The third and fourth pairs of legs have the second joint much longer, and the sixth somewhat shorter, than the corresponding joints of the second pair.

In the last three pairs of legs the second joints are subequal and about twice as long as the third, fourth or fifth; the sixth joint is slender and equal in length to the second; the seventh

is slightly curved at the extremity, and one-third shorter than the sixth.

The first pair of pleopods is elongate, and becomes somewhat wider as the setose apices are approached; the second pair is narrowly lanceolate; the outer ramus is acute at the apex; the inner is oblique-truncated, and bears a long slender stylet on its inner distal angle. Uropods acuminate smooth, with a few scattered hairs along the margins.

This species appears to be quite unique, the abbreviated joints of the antennæ, and the absence of adaptation for flexure of the body at the fourth and following segments of the peraeon, sharply define it from any species hitherto described.

Three examples of this species were obtained off Wata Mooli, in 54 to 59 fathoms.

ARCTURUS OCULATUS, *Beddard.*

Arcturus oculatus, Beddard, Chall. Rep., Zool., xvii., 1886, p. 102, pl. xxv., figs. 1-4.

Stations 37, 57.

Three examples of this well-marked species were obtained off Botany and Wata Mooli, in from 50 to 59 fathoms.

ARCTURUS DENTATUS, sp. nov.

(Figs. 115*a-c.*)

Station 37.

Adult female:—Body about 9 mm. long. Cephalon as long as broad; frontal margin slightly excavated; antero-lateral angles rounded; superior surface with four stoutish spines; the first pair are situated in a line with the anterior third of the eyes; the second pair are on the posterior border; their bases are wide and in a transverse line with the hinder portion of the ocular border.

The first to the fifth segments of the peraeon are armed superiorly with three transverse rows of spines; of these the middle ones are the largest, especially those seated on the supero-lateral aspect of the body; the sixth and seventh have a single row of small spines and a few compressed denticles.

The pleon segments exhibit a few backwardly directed denticles; the caudal shield bears about four sublateral denticles on each side, the last pair being rather large; the extremity of the shield is obtusely pointed.

First peræon segment nearly as long as the cephalon; second and third equal; fourth a little longer than the third.

Eyes rather large, but not prominent; colour blackish-brown.

First antennæ with the basal joint short and stout; second joint more than three times as long as broad; third twice as long as broad; fourth equal to the two preceding joints combined.

Second leg.
Fig. 115*a*.

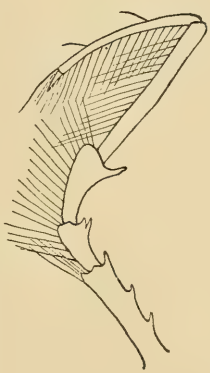
The first joint of the second antennæ is stout, and about 0·5 mm. in length; there are two small spines on the upper border; second joint 1 mm. long; the superior border carries six spines, three on each side of the median line; they are unequal in size, but at regular distances apart; third joint 3 mm. long, fourth 3·5 mm., fifth 1·2 mm., and the sixth 0·25 mm.; the distal extremities of the third and fourth joints are somewhat swollen.

Mandibles stout, straight, with a tridentate cutting edge, and a rather broad spine row; molar tubercle prominent, with an oblique apex.

Maxillipedes short; the epipod is rather large and broadly lanceolate; first and second joints of palp equal, and about as long as broad; third joint twice as long as broad; fourth joint one-third longer than broad; the length of the fifth equals the diameter of the fourth.

In the first pair of legs the third joint is nearly as long as the two following combined; sixth joint equal to the second, and nearly twice as long as the seventh.

Second joint of the second pair of legs four times longer than broad, with three spines on the superior border; third joint about twice as long as broad; the apical third is swollen, and there is a single spine on the superior border near the extremity; the fourth joint is one-third shorter than the second; it gradually increases in diameter distally, and terminates superiorly in a large projecting spine; fifth joint four times as long as the third, with one or two spines on the proximal half of the upper border; sixth joint a little shorter than the fifth; seventh very short, scarcely equal to the diameter of the preceding joint.



Fourth leg.
Fig. 115*b*.

The third and fourth pairs of legs differ from the second in having the second joints longer and the fifth shorter; the

spines on the former are much larger, and on the fifth joints they are absent.

Fifth leg.
Fig. 115*c*.

The second joint of the fifth pair of legs is equal in length to the three following combined; it has a well-marked spine at its inferior base; third joint equal to the sixth; fourth and fifth as long or slightly longer than broad; seventh stout, curved, and about one-tenth shorter than the sixth. The last two pairs of legs are smaller than the pair preceding; the second joints of each are provided with an inferior proximal spine. The pleopods are devoid of any special features. The uropods are lanceolate in shape, and each bears a series of about eight small denticles arranged in an oblique row.

Three specimens were obtained off Botany Bay, in 50 to 52 fathoms.

ARCTURUS ALCICORNIS, sp. nov.

(Figs. 116*a-c*.)

Station 37.

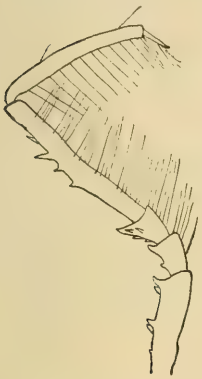
Adult female:—Body about 10 mm. long. The frontal margin of the cephalon is slightly excavated; the externo-lateral borders are produced, and bear three or four spines. There are two prominent spines on the frontal region; each has an accessory spine immediately below; the hinder border bears a pair of spines; these are submedian, and directed outwards; posterior to the eyes there are two obliquely placed spines on each side, and three similar spines occur on the postero-lateral margins.

The first segment of the peraeon is a little longer but not so wide as the cephalon; the second and third are subequal in length, and much wider than the first; the fourth is about a third longer than any of those preceding, and tapers rapidly to its rather narrow extremity; the fifth, sixth and seventh segments are very short mesially; the anterior and posterior borders are excavated and adapted to each other.

The armature of the peraeon is as follows:—The first segment bears a pair of submedian spinules; laterally there is a stoutish bifurcated spine on each side, and several spinules on lower margins. The second and third segments are each provided with four stout antler-like spines, two of which are lateral and two marginal; a few small spines occur at the posterior bases of the large branched spines, and several between the latter and the

median line of the body. The lateral surfaces of the fourth segment are covered with a series of small spinules; the fifth, sixth and seventh are laterally produced; there are submedian, lateral and marginal spines present, but they differ from those of the preceding segments in being short and conical; the armature of the pleon is somewhat similar, and the caudal shield has a pair of stout lateral spines which are situated nearer to the base than the obtusely rounded extremity; the surface carries six spines arranged in two submedian rows of three each; the lateral margins bear six small denticles; the subterminal portion of the shield is tumid, and when viewed from above is seen to be margined with about six small conical spines.

Eyes prominent; colour blackish-brown.

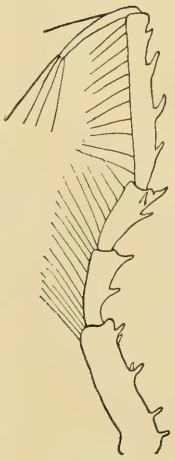


Third leg.
Fig. 116*a*.

First antennæ short, the basal joint stout, about twice as long as broad, with a distinct spinule on the inner distal angle; second joint slender, equal to the first in length; third joint one-third as long as the second, with the apex somewhat dilated; fourth joints and also the second antennæ wanting.

Mandibles stout, strongly bent in the middle; the molar tubercle and spine-row are well developed; cutting edge with three or more denticles.

The maxillipedes have large lanceolate epipods; the first two joints of the palp are subequal and as broad as long; third joint a little longer and broader than the fourth; fifth joint as long as the narrow diameter of the fourth.



Fourth leg.
Fig. 116*b*.

Third joint of the first pair of legs, with a well marked spine, situated at the distal third of the superior border; fourth and fifth joints equal in length; the inferior border of the former and the superior border of the latter are somewhat produced; sixth joint lanceolate in outline; seventh curved, and about one-third shorter than the sixth.

In the second to the fourth pairs of legs the second joints become progressively longer as the end of the body is approached, whilst the sixth joints are correspondingly shorter. The superior border of the second joint is armed with six or more spines

arranged in pairs; the third joint bears two pairs, one median and the other distal; the fourth joint has five or six spines arranged irregularly around the somewhat swollen distal extremity; fifth joint with four equidistant spines, of which the median pair is the largest; sixth joint without spines; seventh slender, tapering, and about four times as long as the diameter of the preceding joint.

Fifth leg.
Fig. 116*c*.

The second joints of the fifth to seventh pairs of legs are armed laterally and inferiorly with short conical spines. The length of the second joint of the fifth leg is about twice that of the seventh; the third joint equal in length to the two succeeding; sixth joint as long as the third; seventh one-fourth shorter than the sixth, slightly curved and truncated at the extremity.

The pleopods are of the usual form. The uropods are lanceolate in shape and bear two rows of submedian denticles.

One specimen of this remarkable species was found in the collection. Unfortunately the second antennæ are wanting. Notwithstanding this deficiency, the species appears to be sufficiently distinct to warrant its description as new.

It was obtained off Botany Bay in 50 to 52 fathoms.

ARCTURUS NODOSUS, sp. nov.

(Figs. 117*a-d*.)

Stations 35, 37.

Adult female:—Body 8 mm. in length. Frontal margin of cephalon slightly excavate; there are two erect spines on the upper surface, situated a little behind the transverse line of the eyes; other scattered spinules are present on the lateral margins. The first and fourth peraeon segments each carry four slender equidistant spines; the second and third are furnished with six, the fifth, sixth and seventh with four.

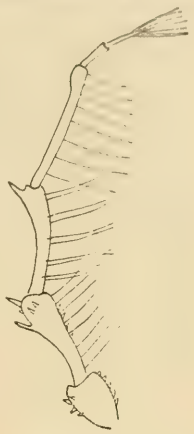
The caudal shield bears six paired spines; the subterminal pair is long and slender; all the spines are weak and easily bent or broken.

Cephalon as long as broad; first peraeon segment short; second and third equal, twice as long as the first and about one-third longer than the fourth; fifth to seventh segments subequal, very

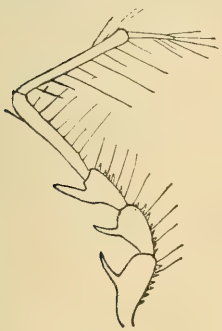
short in the mesial dorsal aspect. Pleon a little longer than the three preceding segments.

Eyes rather prominent, about twice as high as broad, with well defined blackish-brown ocelli.

First antennæ slender, extending to a short distance beyond the middle of the third joint of the second. Basal joint stout, twice as long as broad; second joint elongate, slender; third a little longer than broad; fourth about half as long as the second. Second antennæ about 2·5 mm. long, the first joint broader than long, armed with minute spinules; second joint three times as long as the first; it is evenly curved, with the superior border concave and the inferior convex, the distal half is swollen and bears a few spinules on the lower border and two strong spines on the upper; third joint longer than the second; it is curved throughout its length, dilated distally, and has a single spine at the superior angle; fourth joint longer than the third, slightly curved and somewhat thickened near its spineless extremity; fifth and sixth joints equal in length; the two combined are about half the length of the third. Mandibles straight with a well defined molar tubercle, a broad spine-row and a tridentate cutting edge.



Second antenna.
Fig. 117*a*.



Second leg.
Fig. 117*b*.

The third joint of the first pair of legs has a small spinule on the middle of the superior border; the seventh joint is but little curved and is shorter than the sixth.

Second joint of the second pair of legs more than three times as long as broad; lower border straight, armed with ten or twelve short, stout spinules; upper border curved, with a long spine in the middle. The third joint is a little longer than broad, much wider above than below, with three or four spinules on the inferior border and a long spine on the middle of the upper. Fourth joint longer than the third, twice as long as broad and apically dilated; the inferior border has three unequal spinules, and the upper terminates in a long spine. Fifth joint about one-third longer than the two preceding combined, armed on the inferior border with scattered spinules; the superior distal third is somewhat swollen. Sixth joint a little longer than the fifth, and per-

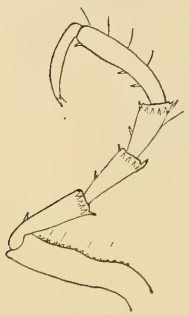
ceptibly thickened at the extremity. Seventh joint curved, tapering, about half the length of the sixth.

The second joint of the fourth pair of legs is nearly twice as long as the corresponding joint of the second; both the upper and lower borders are armed with a series of unequal spinules and five or six spines; some of the latter are equal to or exceed the transverse diameter of the joint; the third to the fifth joints are similar to those of the second pair of legs, but the spinules, spines and the distal thickenings are much more pronounced.

Fourth leg.
Fig. 117*c*.

The second joint of the fifth pair of legs is about three times as long as broad, and of nearly equal width throughout; the superior border is minutely spinulose. The following three joints are successively one-third shorter; each has the basal portion slender, the apical part dilated and encircled with a subdistal series of stout setæ.

Sixth joint nearly as long as the second, slightly narrowed in its proximal third, with a few scattered setæ on the borders. Seventh joint stout, curved and equal to the third joint in length. The sixth and seventh pairs of legs are similar to the fifth, but slightly less in size. The pleopods are devoid of any special features. The uropods are furnished with a few stoutish spines and many small spinules.



Fifth leg.
Fig. 117*d*.

This species is remarkable in having the third to the fifth joints of the outer antennæ and of all the legs, except the first, nodose at their distal extremities.

Four examples of this species were obtained off Botany Bay in 20 to 28 fathoms.

ARCTURUS SERRULATUS, sp. nov.

(Figs. 118*a-c*.)

Station 57.

Adult female:—Body 11 mm. long; the upper surface is ornamented with a series of spines and tubercles; these latter are disposed as follows:—The cephalon carries a pair of compressed spines on the front, immediately behind the truncated anterior

border; they arise from near the inner border of the eyes, and are slightly curved forward; each spine bears two or three spinules on the anterior border. The hinder portion of the cephalon is furnished with two erect and broadly conical tubercles; their bases are nearly in contact in the mesial line of the body; each tubercle is tipped with a small spinule.

The first peraeon segment bears two submedian tubercles, and four lateral spines, two of which are seated on the epimeral plates; the spines are compressed and abruptly bent above the middle, the apices being directed forward.

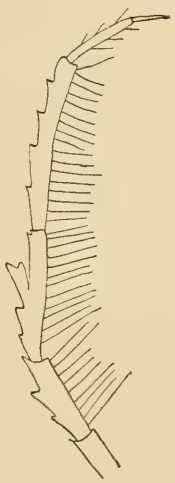
The second to the fourth segments have similar spines, but the submedian tubercles are wanting. In the three remaining segments the armature consists of conical, spine-tipped tubercles. The anterior portion of the pleon bears six sublateral tubercles; the first two pairs are erect; the last pair are very large, and directed obliquely outwards and downwards.

The lateral surfaces of the caudal shield bear numerous compressed spines or denticles; five or six are seriate, and larger than the rest, three of which are lateral and the others submarginal; a median spine is present at a short distance from the obtuse extremity. The uropods are each armed laterally with four compressed denticles.

Eyes black, round and rather prominent. Inner antennæ equal in length to the three basal joints of the outer; second joint one-third longer than the third; both are dilated and acute or spinose at their extremities; fourth joint stout, elongate; inferior border setiferous; the superior border bears two or three denticles near the distal extremity.

Outer antennæ one-sixth shorter than the body; first joint short; second one-fifth shorter than the third; fourth nearly twice as long as the second; fifth half the length of the third; sixth minute. The inferior borders of the second to the fourth joints are fringed with long setæ; the superior border bears ten denticles; of these three occur at equal distances apart on the second joint, and four are seated on the fourth; the third joint also bears three which are close together and confined to the proximal half of the joint; the distal denticle is large, and often has a spinule at its inner extremity.

First pair of legs stout; the second joint is equal in length to the sixth and also to the seventh; the third joint is longer than the fourth or fifth; the latter are equal, about as long as broad, and distally dilated; the fifth

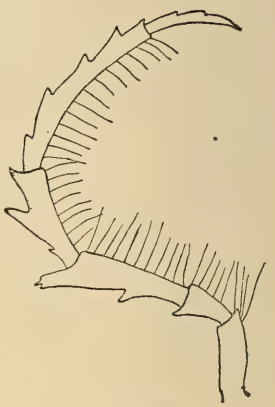


Second antennæ.

Fig. 118*a*.

joint bears a small spine at its superior extremity; inferiorly the sixth joint is excavated for the reception of the seventh when closed.

Second joints of the second to the fourth pairs of legs gradually increasing in length as the end of the peraeon is approached; each has a small denticle near the base on the superior margin; third joints subequal, that of the fourth leg with an acute denticle on the inferior distal angle; fourth joints decreasing in length from the second pair of legs to the fourth; each is armed with a superior distal spine; the fourth joints also have a spine on inferior border; fifth joints subequal, that of the second leg with three denticles on the superior border; the middle one of the three is often very large, and the proximal is small or sometimes absent; the third leg has two similar denticles, and the fourth bears one at the distal extremity; sixth and seventh joints of the second to the fourth pairs of legs gradually decreasing in length; the sixth bears four and the seventh three equidistant denticles on their superior borders. Second joints of the fifth and sixth pairs of legs equal, with four denticles, two proximal inferiorly and two distal on the superior border; second joint of the seventh pair of legs shorter than that of the sixth, with the marginal spines minute or absent. The third and fourth joints are subequal, each has a superior distal denticle, and the lower border of the fourth bears three spinules. Fifth joints short, equal, apically dilated and furnished with three spines on the lower border, the distal one being much the larger. Sixth joint more than two-thirds longer than wide, equal to or exceeding the seventh in length; the superior border bears two small denticles and the inferior four equidistant spines.



Second leg.
Fig. 118*b*.

Fifth leg.
Fig. 118*c*.

The chief feature of this species is the armature of the limbs, which mainly take the form of saw-like teeth, and are very unlike the usual spinose processes found in many other species of the genus.

Two examples of this form were obtained off Wata Mooli, in 54-59 fathoms.

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AUSTRALIAN MUSEUM, SYDNEY.

MEMOIR IV.

SCIENTIFIC RESULTS

OF THE

TRAWLING EXPEDITION

OF

H.M.C.S. "THETIS"

OFF THE COAST OF NEW SOUTH WALES,

IN

FEBRUARY AND MARCH, 1898.

PART 8.—Published 2nd May, 1904.

PUBLISHED BY ORDER OF THE TRUSTEES.

R. ETHERIDGE, Junr., J.P., Curator.

SYDNEY, 1904.

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PART VIII.

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THE ANATOMY OF MEGALATRACTUS.

By H. LEIGHTON KESTEVEN.

THE ANATOMY OF MEGALATRACTUS.

By H. Leighton Kesteven.

I.—Introduction.
II.—Anatomy of *Megalatractus aruanus*.
III.—Anatomy of *Megalatractus maximus*.
IV.—Anatomy of the Genus.
V.—Comparative.
VI.—The Systematic Allocation of the Genus.

I.—INTRODUCTION.

The material used in the present investigation was derived from three sources:—(1) examples of *Siphonalia maxima*, Tryon, obtained during the Trawling Expedition of H.M.C.S. "Thetis" in 1898; (2) specimens taken by the "Deep Sea and Trawling Syndicate" off Broken Bay in 1891; and (3) a large example of *Megalatractus aruanus*, Linn., obtained by Mr. C. Hedley at Mapoon, at the mouth of the Batavia River, Gulf of Carpentaria, Queensland, in May, 1903. Although the apex of the shell and part of the body-whorl of the latter were broken off, the state of preservation of the soft parts was not all that might be wished. The visceral coil was in a thoroughly satisfactory condition, but the preservative used, a mixture of formalin and alcohol, was not strong enough to permeate the muscular tissue of the body, and as a result the organs at the anterior end of the body cavity were far from well preserved. The ganglia of the nerve-ring, the salivary glands, the anterior portion of the œsophageal loop and œsophageal gland, were found to be completely destroyed. The nerves lay loose among these decomposed organs, connective tissue and muscle strands, filling this part of the body cavity.

Nevertheless it is to this specimen that the present paper owes a great deal of its completeness, for, whilst the organs of the body cavities of most of the specimens of *S. maxima* were in a condition fitting them for investigation, the visceral coils of these were almost useless for the purpose, and Mr. C. Hedley* had suggested a relationship between the two molluscs.

* Hedley—Aust. Mus. Mem., iv., 1903, p. 375.

When, therefore, it was found that the "Thetis" material did not allow of a complete investigation, the Curator decided that I should examine the Gulf specimen, and see if it was possible to recover therefrom the details lost from the primary source. The double investigation was rewarded with even better results than we had expected.

The two species prove to belong to one genus, and from the second most of the details lost in the first were recovered.

The following is a concise summary of the results obtained from each investigation, in the order in which they are treated in the following pages.

MEGALATRACTUS ARUANUS, *Linn.* :—

(1) *External features* generally and the organs of the *pallial complex* are described.

(2) *Digestive system.* The alimentary canal itself was dissected out and is described; its position and relation to the other organs are noted, except as regards the anterior end of the œsophageal loop and the nerve-ring.

(3) *Nephridium.* Its shape and macroscopic appearance generally are described.

(4) *Vascular system.* All the principal vessels and sinuses are described, and the circulation of the blood discussed.

(5) *Nervous system* not known.

(6) *Reproductive system.* The specimen was a female; only the ovary and uterus are described.

SIPHONALIA MAXIMA, *Tryon* :—

(1) *External features* and organs of the *pallial complex.*

(2) *Digestive system.* Particular attention was paid to the anterior portion of the system; the relation to the nerve-ring, the œsophageal and salivary glands, are described.

(3) *Nephridium* practically unknown.

(4) *Vascular system.* The only particulars gleaned relate to the heart and aorto-cephalica.

(5) *Nervous system.* All the ganglia and their relations *inter se* are described, except the visceral ganglia.

(6) *Reproductive systems.* Nothing is added to the account of the female complex given under the last species, but the male complex is described in its entirety.

(7) *A section through the proboscis.*

Throughout the two investigations, when the same organ or portion of an organ was obtained in both, it was found to be essentially similar, the differences being of minor importance and such as may well be regarded as specific. It has, therefore, as

already intimated, been concluded that both molluscs belong to the one genus, and are not worthy of even subgeneric distinction. Under these circumstances two courses were open to the writer; one was to sink the term *Megalatractus* and regard *M. aruanus* as a *Siphonalia*, the other was to regard *S. maxima* as a *Megalatractus* and retain both generic terms. This latter is the course adopted, for the following reasons. If we sink the term *Megalatractus*, we, without sufficient evidence, suppose that all the species ranged under *Siphonalia* have the same anatomical characters as the two here discussed. Although all these species probably do possess the same characters, it is better to leave the matter open until additional, and more typical examples have been investigated.

I find that *Siphonalia maxima* has already been listed under the generic name *Megalatractus* by Miss M. Lodder in a list of shells in the Tasmanian Museum.*

The sense of my title, "The Anatomy of *Megalatractus*," and my reason for treating *M. aruanus* first, will now be apparent; the anatomy of the genus, or a summary of the two specific investigations, is rendered in Part IV. of the paper.

The absence of histological details is to be deplored, but the state of preservation of my material put such investigations quite out of the question.

II.—ANATOMY OF *MEGALATRACTUS ARUANUS*, Linn.

1. External features and pallial complex.

a.—External Features.

(Pl. xxxix., fig. 5, and Pl. xl., fig. 2.)

It is unnecessary to describe the shell; this has already been done several times, perhaps the best figure being that of Reeve.†

The *protoconch* (Fig. 119) "has a literature of its own," as stated by Hedley in his "Studies on Australian Mollusca, Part i."‡ This literature is there reviewed, and the synonymy of the species discussed. My use of the specific name *aruanus* is adopted from this paper.

Fig. 119. (nat. size.)

Pilsbry§ described the protoconch thus:—"Cylindrical, white, fragile, hardly tapering, consisting of $6\frac{1}{2}$ remaining whorls, each carinated and obtusely nodulose in the middle, and obsoletely spirally lirate. Last whorl with one or two

* Lodder—Proc. Roy. Soc. Tas., 1900, p. 130.
† Reeve—Conch. Icon., iv., *Fusus*, 1847, sp. 15.
‡ Hedley—Proc. Linn. Soc. N.S. Wales, xxv., 1900, p. 98.
§ Pilsbry—*The Nautilus*, viii., 1894, p. 17.

spiral cords below the peripheral keel, and more distinctly spirally lirate, the base nearly smooth. Aperture one-third the length of the shell; outer lip thin and fragile, columella lip distinctly sigmoid, smooth. Alt. 21, diam. 6 mm." I am favoured with a particularly fine series from the mass of nidamental capsules described by Hedley,* and am able to add to this description. The number of whorls may be stated to be five; I exclude the last of Pilsbry's description, but as the protoconch is ill-defined from the succeeding neanic structure, the number of whorls may vary with the development of the sculpture and in personal opinion. The whorls may be so sharply angulated as to be aptly described by the term "carinated," or they may be evenly rounded. The character "obtusely nodulous" may vary from the verge of extinction to a degree of development quite as great as that indicated in Tryon's figure.†

The obsolete spiral liræ are the first signs of the ultimate adult sculpture, which may extend up the protoconch for three or four whorls, or may only reach the penultimate; but invariably the actual line of extinction is not to be found. Pilsbry's description and the above remarks apply to the decollated protoconch; the portion lost is only a small thimble-shaped cup; it varies both in the direction of its long axis and apparently in size—to what extent may be gathered by a reference to fig. 120. This apical portion, or veliger shell, is quite smooth, and is divided from the rest of the protoconch, or neanic (?) shell, by a deep groove or constriction. The apparent variation in size is due to the fact that the nucleus is shed in the same manner that a human tooth decays and deposits fresh dentine, viz., as the outer layers are corroded off, new layers are deposited inside.

Fig. 120.

The shell of six and one-half whorls described by Pilsbry is possessed of the number of whorls that are present in most of my specimens which were taken from the capsules, but it lacks four or five millimetres of their length. The largest specimen contained in the mass consists of nearly seven whorls, and measures 33 mm. in length; the apical whorl has a diameter of 5 mm., the last whorl is 10·5 mm., whilst the penultimate is only 6 mm. in diameter. This suddenly swollen whorl may be regarded as the first of the true conch, though I believe that the whole protoconch, except the thimble-like apex, is neanic structure.

* Hedley—Proc. Linn. Soc. N.S. Wales, xxv., 1900, p. 508.
† Tryon—Man. Conch., ix., 1887, pl. xxvi., f. 16.

The *operculum* is of the fusoid type (Pl. xl., fig. 1), mytiloid in shape, the nucleus being anterior. There is a slight ridge along the right side, this ridge being more pronounced at the posterior end than at the nucleus.

The sole of the *foot* is of a light burnt umber; the sides also have this colour for a base, but are so flecked and splashed with black as to appear in places quite black. The front margin of the foot bears a groove for the conduction of mucous (?).

There is no *snout*, and the tentacle lobe (*tent. lb.*), which overhangs the orifice of the proboscis sheath is placed far forward, so that that orifice is almost down on the front margin of the foot.

The *tentacles* (*tent.*) are short and thick, and bear the eyes on prominences about a quarter of their length from the end. It would better describe these organs to say that just beyond the position of the eyes they become suddenly thinner.

The dorsal region of the body and the surface of the mantle are of a yellow colour.

The *mantle* along its anterior edge, along the sides, and the siphonal fold, is thick and tough; over the body it is thin. The siphonal fold (*s.*) is rather long, and can apparently be protruded for some length.

The *columellar muscle* is long, though not very thick; it is of a yellow colour, and extends up the columella for a little more than a whorl and a half; the visceral coil is attached to it for as far back as the posterior end of the pericardium.

b.—Pallial Complex.

(Pl. xli., fig. 2.)

The *pallial cavity* extends back to the posterior end of the body, and is there bounded by the nephridium as usual. To the usual number of organs in the pallial cavity there is added a ureter.

The *osphradium* (*osph.*) is oval, tapering at both ends, but rather more gradually posteriorly than anteriorly. It is dark green in colour, and of a large size, therefore a prominent organ. The lamellæ are broader distally than at the point of attachment to the centre cord.

The *ctenidium* (*cten.*) is curved-lanceolate in shape, tapering more gradually posteriorly than anteriorly. It is a dull flesh-pink colour, and extends from well forward in the cavity, on a level with the anterior end of the osphradium, almost to the posterior end of the cavity. Its lamellæ reach their maximum breadth a little distance from their free ends.

The *hypobranchial mucous gland* (*m.g.*) is very large; of the same shape as the ctenidium, it occupies an area as large on the

right side of the cavity, parallel with and mesial to the rectum. Its colour is a dirty brick-red, approaching to brown, and on the tops of the ridges grey. The excreting area is much increased by the throwing of the surface into ridges; of these ridges the most prominent are those which run transversely and diagonally to the long axis of the organ, and between them are smaller ridges arranged longitudinally.

Next to the mucous gland, and parallel thereto, is the rectum (*rect.*); this partly overlies the uterus (*ut.*), which is the organ nearest to the body on the right side. These organs will be described with the systems to which they belong.

2. Digestive System.

(Pl. xlii., figs. 1 and 2.)

The absence of a *snout* has already been noted. The orifice of the proboscis-sheath lying below the tentacle lobe is beset with some eight or nine short thick papillæ.

The *proboscis-sheath* (*pb. sh.*) extends back for some little distance and opens into the proboscis-sac. This sheath is not evaginable, but is fused dorsally with the body wall; ventrally it is attached by numerous muscle strands to a spongy connective tissue which completely fills the body cavity below it; its walls are thick and tough. The cuticle of the inner wall at the posterior, or deeper end of the sheath, is raised up into circularly disposed filamentose lamellæ. As to their function, one can only suggest that they serve to clean the proboscis as it is retracted, and so prevent dirt from getting into the proboscis-sac.

The *proboscis-sac* (*pb. sac*) is an ovoid compartment with thin but tough walls, in which the proboscis is coiled. To the outside of the "sac," just close to the aperture from "sheath" and on the right hand side, there is attached a band of muscle (*p. mus.*) which passes back beside the sac, becomes suddenly thickened when the posterior end thereof is reached, and is attached to the body wall on the right side near the posterior end of the body cavity; but for this muscle the sac lies free in the cavity.

The *proboscis* (*pb.*) is very long, and lies coiled up within the sac; its walls are thick and muscular; it is attached to the left side of the sac near the posterior end.

In typical Prosobranchiata Proboscidea, when the proboscis is fully evaginated there is a portion lying within the proboscis-sheath, and this is the portion which is evaginable. On the other hand, when the proboscis is completely invaginated the anterior end still lies within the sheath.*

* *Vide* "Acrecbolic introvert," fig. 48 in Lankester's article on Mollusca —*Ency. Brit., ed. 9, xvi., Mollusca, 1884.*

In *M. aruanus* what is here termed the proboscis-sheath is the homologue of the proboscis-sheath as generally found, *i.e.*, the permanently invaginated portion, though it is not produced into a pseudo-snout, but lies wholly in the body cavity. The "proboscis-sac" of this mollusc is the homologue of the evaginable and invaginable portion of the typical proboscis. Whether or not it is evaginable cannot be said with certainty, but it seems probable that the posterior half is turned into the anterior half. That it is evaginated so far as to lie within the sheath seems unlikely, in view of its large size, as compared with the cavity of the sheath. The portion here termed "proboscis" is therefore obviously the homologue of the non-invaginable, but protrusible portion of the typical proboscis.

The *mouth* is situated at the anterior end of the proboscis; it is small for so large a mollusc, and is not armed with jaws.

The *odontophore* is large and occupies the greater part of the buccal cavity.

The *radula* is short, and the radular-sac, which is straight, lies below the œsophagus. The teeth on that portion of the radula contained in the sac are on the surface directed ventrally; as the radula enters the buccal cavity it is turned back, so that the teeth come to lie uppermost.

The dental formula is 1, 1, 1 (Pl. xlii., fig. 3). The rachidian is tricuspid, all three cusps close together in the centre of the base, the central cusp largest, the other two much smaller. The base of attachment is broad, but not particularly deep. The laterals are unicuspid; the cusp is a long, bent blade attached to the inner margin of the broad base of attachment. This dentition has been already very briefly described by Macdonald.*

The *œsophagus* (*ant. œs.*) originates from the dorsal surface of the pharynx or buccal cavity and proceeds directly backwards through the proboscis; it is a remarkably small tube for so large a mollusc, in fact the smallness of the cavity of the whole tract is particularly noticeable; it passes out of the proboscis and through the wall of the sac, where the two are attached; thence it turns sharply forward attached to the outer wall of the sac, on the left side thereof, by fine strands of connective tissue; at the anterior end of the sac it bends down and passes forward along the floor of the cavity towards the anterior end; its final position here was lost in the general decay. It was found on the left side of the cavity passing backwards (*post. œs.*) along the floor; after passing out of the body cavity its course is through the pericardium, thence along the axis of the coil to the stomach.

The *stomach* (*stom.*) (Pl. xxxix., fig. 2) is tubular, its lumen not very much greater than that of the posterior portion of the œsopha-

* Macdonald—Ann. Mag. Nat. Hist., (4), i i.,1868, p. 243.

gus, the latter enters it on the axial side of the coil, whence it takes an irregularly spiral course from left to right and anteriorly, and part of the spiral is buried in the digestive gland. The spiral course ends on the axial side on a level with the posterior end of the nephridium. Only very little more than that portion of the spiral lying between the hepato-pancreatic ducts is stomach, the rest is intestine. The wall of the former is thrown into narrow lamellæ and bears two rows of hard nodules along the deeper side; the wall of the latter is thrown into lamellæ so broad and numerous as to almost fill its lumen.

The *intestine* (*int.*) passes forward along the axis through the nephridium to the *rectum* (*rect.*), which extends from the posterior end of the mantle cavity forward to the level of the anterior end of the ctenidium. The lumen of the intestine is only slightly smaller than that of the stomach, whilst that of the rectum is a good deal larger.

A small portion of the *œsophageal gland* or *Leiblin's gland* was found; this was dark sage-green in colour and ribbon-shaped. It lay above the left half of the œsophageal loop, and the main branch of the aorta-cephalica, extending from the anterior limit of investigation to about the middle of the proboscis-sac. The anterior end and its connection with the œsophagus were lost in the general decay in this region.

The *hepato-pancreas* (*hep.*) is a large brown gland occupying the greater part of the visceral coil; it is bounded anteriorly by the nephridium and pericardium, and posteriorly is overlaid by the gonad. The hepato-pancreatic ducts are two in number; the first (*hep. du.'*) opens into the stomach just beyond its junction with the œsophagus, and it evidently bears the secretion of the posterior portion of the gland. The second (*hep. du.''*) opens half way down the first turn of the spiral; this carries the secretion from the anterior portion of the gland.

The *salivary glands* were not found.

3. The Nephridium.

(Pl. xli., fig. 1, and Pl. xxxix., figs. 1 and 3.)

The nephridium (*neph.*) is very large, its shape is somewhat that of a bean, the convex side corresponding to the axis of the coil. The left wall, which separates this organ from the pericardium, is thick and non-glandular, except that portion which contains the pericardial gland. The right wall bears the "glandular mass" of the organ. This glandular mass is in the form of closely packed lamellæ; these are of a dark brown colour, broad and short, but thin. They are arranged somewhat in transverse series between the branches of the nephridial veins; the individual lamellæ running, for the most part, in a direction parallel to the long

axis of the organ. The cavity opens by a large aperture into the *ureter* (*ur.*); this is a muscular pocket, somewhat ovoid in shape, situated in front of the nephridium in the depth of the mantle cavity. The aperture of the ureter is large and easily seen (*ap.*); it can probably be closed by the muscles surrounding it

The *nephridial gland* (Pl. xxix., fig. 3, *neph. gl.*) is situated in, and about the middle of the wall dividing the pericardium and nephridium; it is largest at the posterior end of the pericardium, and is enclosed by the above-mentioned wall, and it here hangs into that cavity as a thick lamella. As the anterior end of the pericardium is reached this lamella becomes smaller till the gland lies flat in the integument of the wall. The colour of the gland is dirty pink, and it is of a spongy texture. Its shape in transverse section and position may be gleaned by a glance at Pl. xxxix., fig. 3. A large number of pores (*pr.*) allow the blood to pass from the cavity of the nephridium into the gland. An injection through one of these pores was seen to diffuse through the gland and collect in the vena cava.

No *reno-pericardial canal*, properly so called, exists, but a connection between the two organs is found in the two branches of the vena-cephalica. For reasons stated later on it is regarded as unlikely that any exchange of contents takes place by this means.

4. The Vascular System.

(Pl. xxxix., figs. 1 and 3.)

The *pericardium* (*p.c.*) is large, and is not nearly filled by the contained organs. Its shape is somewhat that of an *Anodonta*, the umbones representing the dorsal surface; since it is of this shape it cannot be said to bound the mantle cavity, although situated immediately behind it on the left hand side of the nephridium. The outer left hand wall differs only from the posterior part of the mantle in being slightly thicker. The right hand or inner wall is common to both pericardium and nephridium, and has been described with this latter organ. No *pericardial gland* was found.

The *heart* (Pl. xxxix., fig. 4) is of the usual monotocardian type. The auricle (*aur.*) is thin-walled and smaller than the ventricle (*v.*), and they might be aptly compared, as to shape, to two pears attached at their thick ends. The atrio-ventricular valve is composed of several small flaps; that which prevents the return of the blood from the aortæ into the ventricle is of the single flap type. At their inception the aortæ are fused together, but their cavities are separated by a thick partition. There is no main aorta, and the ventricle opens directly into both. A glance at

Plates xxxix., fig. 4, and xli., fig. 3, will explain their arrangement better than words.

The *aorta-cephalica* (*ao. ce.*) passes forward above and is attached to the œsophagus; it gives off no branches till it enters the body cavity, where it immediately bifurcates; the smaller branch crosses to the right side of the cavity, and passes forward, giving off branches in its course; it finally bifurcates, both arms turning down into the foot. The larger branch continues forward along the left side, and the greater number of its branches carry blood to the tissues of the foot and the mantle on the left side, but one particularly large branch crosses towards the right side of the cavity, and turns down into the foot, below the posterior end of the proboscis-sac. The extreme anterior end of this main branch was lost in the general decay.

The *aorta-visceralis* (*ao. visc.*) passes backwards along the axis of the coil; it gives off several small branches in its course.

Of the two, the cephalic artery is very much the larger; their courses and branches were followed by injecting them with prussian-blue, as were all the vessels of this system; and, so small is the visceral artery, immediately behind the pericardium, that it could not have been followed without the injection.

Some of the veinous sinuses are very distinct vessels, and one at least has distinct walls of its own, and is a veritable vein.

For the convenience of description and discussion it has been found advisable to give these sinuses names. They are, therefore, termed—*vena-maxima*, *vena-cephalica*, *vena-cava*, *venæ-pericardiales*, and *efferent branchial vein*.

The *vena-maxima* (*ve. mx.*) is the largest of the sinuses; posteriorly it communicates freely with the lacunæ of the visceral coil, and passes forward along the lower or axial side of the nephridium to communicate with the large *rectal sinus* (*rect. si.*), and a smaller sinus lying between the uterus and body proper. In the nephridium it gives off large but short branches which pass up the right wall or glandular mass of the nephridium towards the dorsal side. These branches are self-contained, that is, they are provided with walls of their own. The wall of the *vena-maxima*, which separates its cavity from that of the nephridium, may be well regarded as serving that purpose only, so that in the nephridium this sinus might almost be looked upon as a veritable vein.

The walls of the rectal sinus (*rect. si.*) and mantle adjacent to it are of a spongy texture, owing to their being perforated by innumerable small sinuses; the largest of these pass below the mucous gland towards the ctenidium. There is no large sinus connecting any part of the vena-maxima with the vena-cephalica.

The *vena-cephalica* (*ve. ce.*) is a large, well-defined sinus, not having distinct walls of its own, but lying in the integument connecting the visceral coil and body. This sinus communicates

freely with the hæmocœle of the body cavity, and is, in fact, a prolongation of that cavity. Just anterior to the nephridium this sinus bifurcates, each branch being about half the size of the main trunk. One, the pericardial branch (*ve. ce. per.*), passes back in the wall dividing the pericardium and nephridium, and opens into the former at the anterior end, below the nephridial gland. The other, or nephridial branch (*ve. ce. neph.*) pierces the wall of the nephridium, and at once becomes a veritable vein. It passes upwards and along the dorsal edge of the glandular wall of the nephridium, sending down branches which lie between those of the *vena-maxima*, and, like them, end in fine capilliaries on the glandular lamellæ.

The *vena-cava* (*ve. ca.*) is a short sinus not having distinct walls of its own, but with a large and well defined cavity. It lies along the lower edge of the nephridial gland, and continuing forward in the wall dividing the nephridium and pericardium, it passes through the mantle to join the branchial vein, a little anterior to the auricle.

The *efferent branchial vein* (*ve. br.*) also has no distinct walls of its own, but lies in the mantle; it is, nevertheless, a well-defined vessel, and its course is as usual along the ctenidium to the auricle.

The *venæ pericardiales* (*ve. per.*) are two large veins which might almost be regarded as posterior prolongations of the pericardium. Without using any force the injection passed through them along the axis of the coil for a short distance, and then became diffused around the hepato-pancreas. These two veins have no distinct walls of their own, but lay in the tissues and muscles of the axis of the coil.

As previously stated, there is a possible reno-pericardial communication by means of the two branches of the vena-cephalica, but, for reasons stated below, it is regarded as extremely unlikely that this communication or interchange of contents does take place.

Circulation.—It is evident from the arrangement of the vessels of the system, that blood may pass from the aorta-cephalica to the efferent branchial vein by means of lucunæ, and also that it passes direct from the nephridium, through the nephridial gland and vena-cava, to the auricle, but the direction of flow of the blood in the veins is not so evident. It seems that both the nephridial veins are afferent vessels, and that all the purified blood passes through the nephridial gland to the heart. The considerations which lead to this conclusion are :—

1. The vena-maxima is obviously an afferent nephridial vein.

2. The greater portion of the blood which passes through the heart is conveyed to the body by the aorta-cephalica, it therefore

seems unlikely in the extreme that the vena-cephalica also conveys blood to that region.

3. Since the pericardial branch of the vena-cephalica is smaller than the main trunk, it is highly improbable that the nephridial empties into the other branch, because, in that case, the trunk must *also* empty into the pericardial branch.

In view of these facts it is evident that *neither* of the nephridial are efferent veins.

There are, it seems, three circuits of circulation in this mollusc: one branchial and two nephridial.

(1) The *branchial* circuit is that of portion of the blood carried forward by the cephalic artery; its course is from the aorta-cephalica by lacunæ to the efferent branchial vein, and by this vessel back to the heart.

(2) The *cephalico-nephridial* circuit is also that of a portion of the blood carried by the aorta-cephalica; from this vessel it collects into the sinuses in communication with the vena-cephalica and rectal sinus, and by these vessels is conveyed partly to the nephridium, partly to the pericardium. From the cavity of the nephridium it passes through the pores into the nephridial gland and is carried thence to the heart by the vena-cava.

(3) *Viscero-nephridial* circuit. That portion of the blood carried posteriorly by the vena-cephalica, which enters the pericardium, passes through that cavity to reach the visceral coil by the venæ-pericardiales. From the lacunæ of the visceral coil it passes through the vena-maxima, accompanied by the blood from the aorta-visceralis, to reach the nephridium; thence its course is as in the *cephalico-nephridial* circuit.

5. Nervous System.

No trace of this system was found. The central ganglia, *i.e.*, the cerebral, pleural and pedal, had rotted away, and the nerves were washed about and became indistinguishable from the numerous muscle strands lying in the body cavity before it was realised that they were no longer attached to their respective ganglia.

6. Reproductive System.

(Pl. xxxix., fig. 1.)

As stated in the introductory remarks, the single specimen was a female; nothing is therefore known of the male organs, and of the female only the macroscopic aspects of the gonad and uterus.

The *gonad* (*go.*) is rather small; it is situated near the apex of the visceral coil, there it overlies the digestive gland, and it is of a yellow colour.

The *uterus* (*ut.*) is a large uncoiled tube with very thick glandular walls, lying in the mantle cavity, on the right side close to the body. The anterior end, which communicates directly with the exterior through the genital aperture, is on a level with the anus; the posterior end is continued up the coil for a short distance on the right side of the nephridium. This end is probably a blind cæcum, for it is unlikely that the oviduct opens into it; rather would the oviduct pass forward below the nephridium and open into the uterus at the posterior end of the mantle cavity. The glandular masses which are attached to the wall of the uterus, and occupy the greater part of its cavity, resemble pieces of tallow candle; these masses are arranged in longitudinal rows.

The mass of egg capsules has been figured by Hedley in his "Studies on Australian Mollusca" from material forwarded him from Bundaberg, Queensland, by Dr. T. H. May.*

III.—ANATOMY OF *MEGALATRACTUS MAXIMUS*, Tryon.

1. External Features and Pallial Complex.

(Pl. xl., fig. 5.)

The shell has recently been redescribed and figured by Hedley† in the paper already referred to.

The *protoconch* (Fig. 121) is present in only one of the many specimens at my command; it consists of about two smooth, rounded whorls of equal diameter. It is not defined from the succeeding neanic structure, but, as in *M. aruanus*, the sculpture of that portion of the shell ascends on to the protoconch and fades out so gradually that the actual line of extinction cannot be found. The nucleus has been cast from my single example, and the two whorls described are the homologue of the six and a half angulated whorls of the protoconch of the last species.

Fig. 121.

The *operculum* (Pl. xxxix., fig. 7) is similar to that of *M. aruanus* except that the ridge described as being on the right side of that operculum is absent from this.

The *foot* and body also agree with the last species in shape, differing only in being smaller and flecked with brown instead of black.

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* Hedley—Proc. Linn. Soc. N.S. Wales, xxv., 1900, p. 508, pl. xxv., f. 18.

† Hedley—Aust. Mus. Mem. iv., 1903, p. 374, pl. xxxviii.

Of the *pallial complex* it is sufficient to say that the *osphradium*, *ctenidium*, *rectum*, and *uterus* differ from those organs in *M. aruanus* only in being proportionately smaller.

The *hypobranchial mucous gland* is more than proportionately reduced; it presents none of the complex arrangement of ridges in this species which it does in the last.

The *ureter* is absent.

The position of the *vas-deferens* and *penis* will be described in connection with the reproductive organs.

2. Digestive System.

(Pl. xxxix., fig. 6.)

The *orifice* of the *proboscis sheath* (*pr. sh.*) is situated, as in the last species, close down to the front margin of the foot, and is overhung by the tentacle lobe and tentacles. The sheath itself is not so intimately fused with the dorsal body wall as in *M. aruanus;* on the contrary, it is a self-contained portion of the proboscis, and though attached to the body wall by numerous strands of muscle and connective tissue, may be dissected out, only a few millimetres of the anterior end being completely fused with the wall, nevertheless, it is not evaginable.

The *proboscis sac.* (*pb. sac.*) is longer and smaller in diameter than in the last species, but is otherwise essentially similar.

The *proboscis* is longer in this species than in the last.

The *mouth*, *buccal mass* and œsophagus within the proboscis, are all essentially similar to what was found in *M. aruanus.*

The *radula* (Pl. xl., fig. 4) is of the same length and dental formula (1, 1, 1) as in the last species, but the individual teeth are somewhat different. The rachidian is tricuspid, cusps nearly equal sized, the central slightly the largest, the lateral cusps attached much nearer the margin of the base than in *M. aruanus*; base of attachment half as deep as broad. Laterals tricuspid, base of attachment not deep; the outer cusp the largest, placed at the extreme outer margin of the base, the other two cusps equal in size, attached near the inner margin.

The *œsophagus* issues from the proboscis at the posterior end of the sac, and passes forward attached to the left side thereof (*ant. œs*). At the anterior end of the sac it bends down and comes to lie on the floor of the body cavity. It here becomes suddenly swollen, and then slightly narrowed again, but is thence for the rest of its length a larger tube than that portion which lies between the swelling and the buccal cavity. These two portions may be distinguished as the "anterior" and "posterior" œsophagi. The posterior œsophagus (*post. œs.*) continues forward to the anterior end of the body cavity, where lie the main ganglia,

and is then bent back upon itself. The returning arm passes through the nerve ring, and back along the left side of the cavity, through the pericardium to the stomach, which is similar in form and position to that of *M. aruanus*.

The *intestine* and *rectum* also conform to the description given under the last species.

The œsophagus in passing through the nerve ring, lies above the right half of the cerebral loop and the right pleural ganglion, under the centre and left half of the cerebral loop, above the left pleural ganglion and the sub-intestinal ganglion, and below the supra-intestinal. After passing through the nerve-ring the œsophagus receives the duct of the œsophageal gland; this duct (*du.*) is short and very large, and its calibre is quite half as large as that part of the posterior œsophagus, into which it opens.

The *œsophageal, or Leiblin's gland,* (*œs. gl.*) is a large lamelliform organ of a dark brown colour. It consists of three parts, two anterior oval portions connected together in the middle line, and a posterior ribbon-like prolongation attached to the left anterior piece. The duct arises from the right anterior piece, which is situated on the floor of the body cavity; the isthmus joining this to the left-hand piece rises toward the dorsal aspect of the cavity, and the left-hand portion lies just below the body wall above the posterior œsophagus. The isthmus which joins this to the posterior prolongation bends downward, and the œsophagus lies above it. This isthmus is not connected to the anterior end of the posterior prolongation, but a little behind it, and the anterior end is bent up so as to lie above the œsophagus; the rest of this ribbon-like portion lies on the floor of the cavity, just to the right of the main branch of the aorta-cephalica. The walls of the gland are delicate, though thick, owing to the epithelium of the inner sides being raised into fine closely placed ridges. The cavities of all the portions are in free communication through the isthmuses. The sudden swelling at the junction of the œsophagi is to be looked upon as the much reduced *œsophageal cœcum* (*œs. cœ.*).

The shape of the *salivary glands* was not ascertained, owing to their being mixed up with the connective tissue filling the anterior end of the body cavity. They are both of a yellow colour, and apparently the right is somewhat the larger. Whether the ducts pass through the nerve-ring was not ascertained, probably they do not, judging from the position of the glands, which is posterior to the ring. No trace of the ducts was found elsewhere than in the proboscis; here they lie one on each side of the œsophagus; they open as usual into the buccal cavity.

The *hepato-pancreas* is of the same size (proportionately) and appearance as in *M. aruanus*. Only one duct was found—that which corresponds to the first described in that species—this is

not to say that the other does not exist; it probably does, but owing to the poor condition of my material was not found.

3. Nephridium.

Of this organ I can only say that its external appearance is similar to that of *M. aruanus*. The glandular lamellæ and reticulation of blood vessels were completely destroyed. One or two pores were found occupying a position similar to that of the pores of the nephridial gland in the last species, but no trace of the gland was found. There is no *ureter*, and the *reno-pallial orifice* is large and easily seen.

4. Vascular system.

(Pl. xxxix., fig. 6.)

The most careful attempts at injection met with complete failure, as the walls of the vessels were too soft to retain the fluid. This section is, therefore, confined to the pericardium, heart and aorta-cephalica.

The *pericardium* is disproportionately smaller than that of *M. aruanus*, and is almost filled by the contained organs, namely, heart, aortæ and posterior œsophagus.

The *heart* almost exactly resembles that of the other species, and is hardly, if at all, smaller.

The *aortæ* are fused at their origin, as in the other species; only that short piece of the aorta-visceralis, lying within the pericardium, was seen.

The *aorta-cephalica* (*ao. ce.*) passes forward in the same course as in the species just discussed, but the right branch is quite insignificant when compared with this branch in that species. At the anterior end of the body cavity the artery lies in the middle line; just posterior to the nerve-ring it gives off a branch which passes down into the tissues of the foot; it then passes through the nerve-ring, in the same course as the œsophagus, and immediately divides into three. Two of these pass down into the tissues to supply the propodium, the third branch bends back, and accompanies the œsophagus along the proboscis sac, and into the proboscis.

5. Nervous System.

(Pl. xl., figs. 2 and 3.)

This system was only dissected out with difficulty. The trouble arose from two causes, one was that the material had been in weak alcohol for nearly thirteen years; but more serious than this was the fact that the anterior end of the body cavity was, as in the

other species, filled with connective tissue, among and attached to which were the numerous fine muscle strands which retained the proboscis sheath in position.

The nerve ring is situated at the extreme anterior end of the body cavity, almost under, but slightly behind, the orifice of the proboscis sheath. The pedal ganglia are not imbedded in the tissues of the foot, but lie just on the surface of the floor of the cavity. The most noticeable feature is, as in related genera, the fusion, not only of ganglia, but also of their commissures.

The *cerebral ganglia* and their commissure (*ce. g.*) are fused into one loop, on the left hand side the cerebro-pedal commissure also enters into the composition of the "loop." This "cerebral loop" is placed somewhat diagonally; on the left hand side it is attached to the pedal ganglion of that side, and here it has the corresponding cerebro-pleural and pleuro-pedal commissures fused with it (*c. pl. pd. com.*). On the right side it is fused with the corresponding pleural ganglion, and gives off a pedal commissure which is fused with the pleuro-pedal commissure of this side for the greater part of its length (*c. pd. com.*)

The *left pleural ganglion* (*l. pl. g.*) is represented by a short stout cord, which, as already stated, is fused at its base with the cerebral loop and pedal ganglion, this basal portion being the fused cerebro-pleural, pleuro-pedal, and cerebro-pedal commissures. At its distal end this cord is slighty constricted, and then swells into the sub-intestinal ganglion. The *right pleural ganglion* (*r. pl. g.*) is rather better differentiated from its pedal commissure (*pl. pd. com.*), but is intimately fused with the cerebral loop on this side; it may, however, be distinguished from it to a certain extent by a depression between the two on the inner side of the ring. The commissure which connects this with the supra-intestinal ganglion, although short, is well differentiated from both ganglia.

The *pedal ganglia* (*pd. g.*) are large, and, as usual, give off a multitude of nerves to the foot, the largest pair of which are metapodial nerves, springing from the inner, mesial side of each ganglion. The various pedal commissures have already been described.

The *sub-intestinal ganglion* (*sb. int. g.*) is, as already stated, but a differentiated portion of the left pleural ganglion; it is attached by a very short commissure to the right cerebral ganglion. There is thus a condition of zygoneury on the right side.

The *supra-intestinal* (*sp. int. g.*) is a well-defined oval ganglion attached by a short commissure to the right cerebral ganglion.

The *buccal ganglia* are situated below the œsophagus, in the angle formed by its insertion into the buccal cavity; the buccal commissure was not found.

The *visceral ganglia* were not found.

The *left visceral connective* (*l. v. con.*) rises from the right hand side of the supra-intestinal ganglion. The *right visceral connective* (*r. v. con.*) rises from the left hand side of the sub-intestinal ganglion.

The *right mantle nerve* (*r. m. n.*) rises from the right hand side of the sub-intestinal ganglion. The *left mantle nerve* (*l.m.n.*) takes origin from the left cerebral ganglion near its base. There is a *branchial nerve* (*br. n.*) given off by the supra-intestinal ganglion. This branchial nerve and the left mantle nerve anastomose, and give rise to a dialyneurous condition on the left side.

The *columellar nerve* (*col. n.*) arises from the left cerebral ganglion, just above the mantle nerve.

The *cerebro-buccal connectives* (*c. buc. con.*) originate from the cerebral ganglion ; the left from near the base of the loop on that side ; the right from near the top of the loop on the corresponding side.

Between the right visceral connective and mantle nerve there arises a nerve (*gen. n.*) which I am inclined to regard as genital, but am doubtful about it, not having been able to find its ultimate branches.

Three or four nerves arise from the right cerebral ganglion, about which nothing is known.

6. Reproductive Systems.

(Pl. xl., fig. 5.)

Male—The *gonad*, as is usual, is situated around the digestive gland near the end of the visceral coil, it is of a yellow colour and not very large.

The *vas-deferens* passes forward along the right side of the digestive gland, on the surface of which, just behind the nephridium, it is much coiled ; it then turns down to the axis and passes forward below the nephridium. In the mantle cavity it lies on the mantle close to the body on the right side, about half way forward along the cavity it makes an S-shaped curve and comes to lie on the body (*v.d.*), where it is plainly seen as a ridge passing forward to the base of the penis.

The *penis* (*p.*) is remarkably large ; it is carried folded back upon itself, and lying in the mantle cavity along the right side of the body parallel with and just to the left of that portion of the vas-deferens attached to the body. In the figure the penis is represented raised up and bent slightly to the left, so that the vas-deferens may be shown. The former is attached to the body well forward, just a little behind and to the right of the tentacle lobe; in transverse section it is oval, its shape otherwise is shown in the figure. The *ductus ejaculatorius* passes through the penis

and opens at the tip of the organ on a papilla which is partly enclosed in a muscular sheath or depression. Whether this papilla is extensile or not I am unable to say; it certainly is not evaginable, but is a solid piece of soft tissue.

Female—The *ovary* and *uterus* conform in all particulars to the descriptions of these organs given under the other species. The *oviduct* was not found, and for this omission I must again plead the poor state of preservation of the material examined.

7. A Section through the Proboscis.

(Fig. 122.)

Although the state of preservation of the specimens was such as to make the use of the microtome valueless for histological research, I have made a few thick sections (at about 20 μ) of the

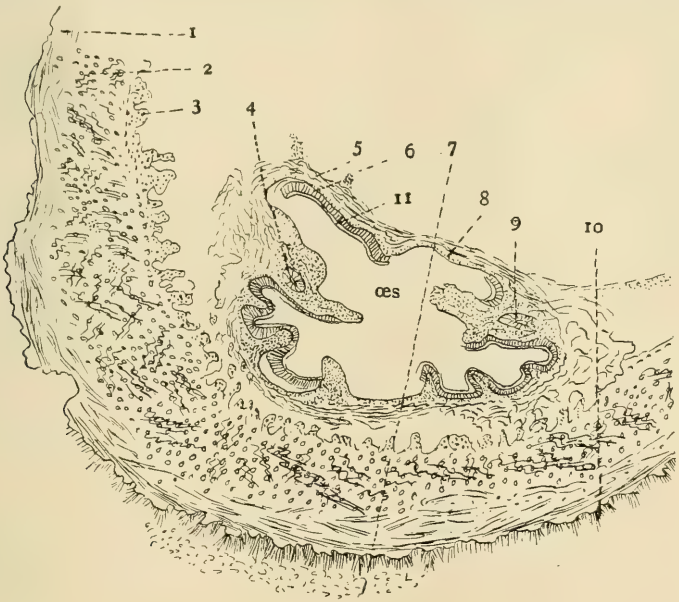

Fig. 122.

Camera lucida sketch of the œsophagus, salivary ducts, and portion of the wall of the proboscis, on a level with the middle of the radular-sac.

1, Circular muscle strands; 2, a layer composed of muscle strands and connective tissue; 3, longitudinal muscle strands; 4, salivary duct; 5, circular muscle strands; 6, enteric epithelium; 7, cuticle; 8, longitudinal muscle strands; 9, salivary duct; 10, deric epithelium; 11, cuticle; œs., œsophagus.

anterior end of the proboscis for anatomical research. The tissues are very much spoiled and displaced, but the organs lie

in what must be approximately their natural position, as also do patches of tissue, so that I am enabled to give the sequence of tissues (it is, however, quite out of the question to attempt to describe them), as well as describe the position of the organs.

The wall of the proboscis is made up of five layers of tissue, they are cuticle (7), deric epithelium (10), circular muscle strands (1), a layer composed of connective tissue, diagonal and longitudinal muscle strands (2), and the innermost layer, longitudinal muscle strands gathered into bundles (3).

The *radular-sac* occupies the greater portion of the cavity of the proboscis anteriorly; its wall consists of, from without inward, circular muscle strands, longitudinal muscle strands, columna epithelium of which the cells are of medium length, and a layer of cuticle. No sign of cœlomic epithelium was found, nor was it expected. The odontophore cartilage is saddle-shaped, but the "flaps" are thicker than the "seat." Owing to the general destruction I was unable to see the arrangement of the tissues of the odontophore. There seems to have been a band of transverse muscle strands across the convex side of the seat; down the sides there was apparently a layer of longitudinal strands, and outside this a layer of short epithelial cells.

The *œsophagus* is placed dorsally to the radular sac, and lies just under and attached to the dorsal wall of the proboscis. Its wall, which is much folded inwardly, consists of a layer of circular muscle strands (5), one of longitudinal strands (8), enteric epithelium (6), and a thick layer of cuticle (11).

The *salivary ducts* (4 and 9), lined with a flat epithelium, are situated in two isthmuses which extend into the lumen of the œsophagus; they are imbedded in connective tissue and longitudinal muscle strands.

IV.—ANATOMY OF THE GENUS.

1. External features.

The shell. As in the specific descriptions, so in the generic, I must refer my readers to descriptions already published; these will best be found by reference to Hedley's papers previously quoted.

The *protoconchs* differ in the two species, but these differences are of degree rather than of kind, and both are referable to the one type, which may be termed the *Perostylus* protoconch.

Operculum fusoid, nucleus anterior, component rings slightly imbricating.

The *foot*, as far as may be judged from contracted spirit specimens, is large, and bears along the anterior margin a well-developed mucous (?) groove.

There is no *snout*, and the tentacle lobe is far forward, so that the orifice of the proboscis-sheath is close down to the front margin of the propodium.

The *tentacles* are short and are suddenly reduced in diameter above the position of the eyes.

The *columellar muscle* is fairly long, though not very thick ; it extends up the visceral coil as far as the posterior end of the pericardium.

The *mantle* is thick and tough anteriorly and along the sides, but over the body rather thin.

The *siphonal fold* is long, thick and tough ; it may evidently be protruded for some little distance.

2. Pallial complex.

The *pallial cavity* as usual is co-extensive with the dorsal surface of the body, and is bounded at the posterior end by the nephridium.

The *osphradium* is large, situated well forward on the left-hand side of the cavity, of oval shape, and dark green colour.

The *ctenidium* is also large, and a prominent organ on the left side of the cavity ; it is of a flesh-pink colour, and extends from, on a level with the anterior end of the osphradium, almost to the posterior boundary of the cavity.

The *hypobranchial mucous gland* is well developed, and may have a much folded surface.

The *rectum* and *uterus*, or *vas-deferens*, lie parallel with one another on the right side.

The cavity may or may not contain a *ureter* at the posterior end.

3. Digestive system.

The proboscideal complex consists of three well differentiated parts.

A *proboscis-sheath*, neither invaginable nor evaginable, but firmly attached throughout its length, to the dorsal body wall.

A *proboscis-sac*, probably slightly evaginable, and containing the :—

Proboscis, which is protrusible and retractile, but not invaginable.

The *mouth*, situated at the end of the proboscis, opens into the small buccal cavity.

The *radula* is of the *Fusacea** type. The presence of only one cusp on the laterals of *M. aruanus* is of very secondary importance.

The *œsophagus*, owing to the great length of the proboscis, is very long ; it consists of anterior and posterior sections. The

* Troschel—Das Gebiss der Schnecken, ii., 1868, pp. 69-86.

anterior œsophagus is bent sharply forward, where it issues from the proboscis, at the posterior end of the sac. The *posterior œsophagus* is bent back on itself, where it passes through the nerve-ring, at the anterior end of the body cavity; it then receives the duct of the œsophageal gland, and passes back, along the left side of the cavity, through the pericardium, and up the axis of the coil to the stomach.

The *stomach* is tubular, and has a lumen not very much greater than that of the posterior œsophagus; near their junction it takes a somewhat spiral course on and through the digestive gland, and is joined by the *intestine*; this passes through the nephridium to the *rectum* lying along the mantle on the right side of the cavity, the *anus* being situated well forward almost on a level with the anterior end of the ctenidium.

The *œsophageal gland* is an irregularly shaped lamella, lying mostly in the anterior end of the body cavity, but having a ribbon-like prolongation continued back for some distance.

There is one pair of *salivary glands* situated in the anterior end of the body cavity, just posterior to the nerve-ring. The salivary ducts are long, in conformity with the length of the proboscis.

The *digestive* gland is large; there are two ducts, one opening into the proximal, the other into the distal end of the stomach.

4. Nephridium.

This organ is situated in the usual position, immediately behind the pallial cavity, on the right-hand side of the visceral coil. It is rather large, and approaches somewhat to a bean in shape, the convex side being in the axis of the coil.

The *glandular mass* is very thick, and occupies the whole of the right side of the organ; the individual lamellæ are broad and short.

The *cavity* of the organ is spacious, and communicates with the pallial chamber either through a simple *reno-pallial orifice* or per medium of a small, somewhat ovoid, muscular *ureter*.

The *nephridial gland* is well differentiated, and lies in the wall separating the pericardium and nephridium; with the cavity of the latter it communicates by numerous pores; along its lower edge is the sinus which is here termed the vena-cava.

5. Vascular system.

The *pericardium* may be either large or rather small; besides the heart and aorta, it contains a section of the posterior œsophagus.

The *heart* is of the usual monotocardian type.

The *aorta-cephalica* is very much the larger of the two arteries, and its name implies its function ; the main branch lies along the left side of the body cavity.

The *aorta-visceralis* is a very small vessel for so large a mollusc ; it passes up the axis of the visceral coil, giving off small branches in its course.

The *vena-maxima* is a large venous sinus, which places the lacunæ of the visceral coil in communication with the *rectal sinus*, and gives off numerous branches to the glandular mass of the nephridium.

The *vena-cephalica* is a very much reduced posterior prolongation of the body cavity, and places that large sinus in communication with the pericardium and nephridium. The nephridial branch gives off numerous branches which lie on the surface of the glandular mass and between the branches of the vena-maxima.

The *vena-cava* is a short sinus placing the pericardial gland in communication with the auricle.

The *efferent branchial vein* forms a distinct ridge along the left side of the ctenidium ; its cavity is well defined.

The *venæ-pericardiales* are two sinuses connected with the posterior end of the pericardium, and placing that cavity in communication with the lacunæ of the visceral coil.

For the course of circulation, see p. 429.

6. The Nervous System.

As absolutely nothing is known of this system in *M. aruanus*, a generic summary of the characters is impossible ; it is, therefore, unnecessary to repeat the description given under *M. maximus*.

7. Reproductive Systems.

Male.—The *gonad* is not large ; it has the position usual in the Monotocardian Prosobranchs.

The *vas-deferens* is coiled for a short distance, but for the greater part of its length takes a direct course. In the posterior half of the pallial chamber it lies on the mantle, thence to the penis it lies on the body.

The *penis* is large, oval in transverse section, attached on the right side of the body, just behind the tentacle lobe. It is carried folded back and appressed to the body on the right side, in the pallial chamber.

Female.—The *gonad* is macroscopically similar to that of the male.

The *uterus* is large, situated in the pallial cavity on the right side between the rectum and body, and it extends for a short dis-

tance up the visceral coil on the right of the nephridium. The walls bear numerous large glandular swellings. The *orifice* is situated well forward on a level with the anus.

The characters which have been seen in both species are :—The external features generally and the organs of the pallial complex, the proboscideal complex, the alimentary canal (except the anterior portion of the œsophageal loop), the ribbon-like posterior prolongation of the œsophageal gland, the hepato-pancreas and the first hepato-pancreatic duct, the external appearance of the nephridium and the pores of the nephridial gland, the pericardium, heart and cephalic artery, and finally the uterus and ovary.

The most important points of difference are :—The presence in one and absence from the other of a ureter, the degree of development of the hypobranchial mucous gland, and the form of the individual teeth on the radula.

With these two exceptions all the organs observed in both species are essentially similar.

The most important omissions from the account are :—The visceral ganglia and visceral commissure, the otocysts and otocyst nerves, and the oviduct.

V.—COMPARATIVE.

The protoconchs of the two species are (p. 438) stated to be of the one type, which is there termed the *Perostylus* protoconch. The name is adopted from Pilsbry's* two papers on the larval shell of *M. aruanus*. It must, of course, be admitted that they are rather extremes of this type, which may be defined as :—A turretiform protoconch, having whorls not increasing, or increasing very slightly in diameter, and having a comparatively large nucleus. Besides the two apices here discussed, those of the following are also referable to this type:—*Fusus hexagonalis*, Tate,† *Turbinella regina*, Heilprin,‡ and perhaps also that of *Chrysodomus contraria*, Linn.,§ but the figure of this is poor and the protoconch itself has not been seen by the writer.

A glance at the figures referred to and those on pp. 421 and 431 accompanying this paper will show that these apices may reasonably be grouped together, and that the most important differences between them lie in the number of whorls. This fact may be further demonstrated by covering up so much of the figures that all shall appear with the same number of whorls.

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* Pilsbry—*The Nautilus*, viii., 1894, pp. 17 and 67.

† Harris—Brit. Mus. Cat. Tert. Moll., i., Australasia, 1897, p. 131, pl. v., f. 5.

‡ Dall—Tert. Moll. Florida, (Trans. Wagner Free Inst. Sci.), iii., 1, 1890, p. 98, pl. iii., f. 4.

§ Baker—Ann. N.Y. Acad. Sci., ix., 1897, p. 694, fig. 33.

"It is obvious from the bulk of the larval shell that *M. aruanus* can have no free-swimming stage."* A careful study of this protoconch has led me to conclude that the latter whorls are neanic, the thimble-shaped cap probably veliger structure. I have discussed the stages of growth represented by the first of these protoconchs more fully in a paper on "The Ontogenetic stages represented by the Gasteropod Protoconch," now in the press.

Of the *operculum*, it is almost sufficient to say that it is of the fusoid type. There is, perhaps, a closer resemblance to the Turbinellid operculum than to any of the many others of this type.

In the absence of a *snout*, and the position of the tentacles and tentacle lobe, *Megalatractus* resembles *Fasciolaria filamentosa*, Lamk., as figured by Quoy and Gaimard.† In this respect it differs from *Melongena* ("*Pyrula*") *tuba*, Lamk., which is figured by Souleyet‡ as having a very long snout.

It agrees with *M. tuba* in the development of the *hypobranchial mucous gland*, the form of *osphradium*, and *ctenidium;* in the possession of a well developed mucous (?) groove along the front margin of the foot; in the position of the vas-deferens on the body, and the point of attachment of the penis; the last organ, however, is larger in our genus than in Souleyet's example. A description of the hypobranchial gland of *Fasciolaria tulipa* by F. Bernard§ is, in the main, equally applicable to our first species, *M. aruanus;* whilst the osphradium is similar to that of *Cassidaria*, as described by the same writer.‖

I can find no description of a proboscideal complex which resembles that of our genus; that of *Pyrula ficus* (Linn?), as described by Amadrut,¶ being that which perhaps most nearly approaches the arrangement obtaining in *Megalatractus.* In that species we find a proboscis-sheath, "le trocart," and sac, which, however, this author terms "la gaine"; but the proboscis, instead of lying simply coiled up in the sac, is invaginated into itself, and so lies in that cavity as an irregularly pyriform mass. The complex of *Melongena tuba* is probably the same as that of *Megalatractus.* The proboscis is very long, and is represented by Souleyet as lying coiled up in the body cavity when retracted.** I find it hard to understand these drawings, and it seems possible that they are somewhat incorrect. If they are correct, then no portion of the proboscis is invaginable or evaginable. There is only a short length of the œsophagus

* Hedley—Proc. Linn. Soc. N.S. Wales, xxv., 1900, p. 598.
† Quoy and Gaimard—Voy. "L'Astrolabe," Atlas, pl. 35, f. 2.
‡ Souleyet—Zool. "Bonite," ii., 1852, Atlas, pl. 43.
§ Bernard—Ann. Sci. Nat., (7), ix., 1890, p. 337.
‖ Bernard—*Loc. cit.*, p. 140.
¶ Amadrut—Ann. Sci. Nat., (8), vii., 1898, p. 20.
** Souleyet—Zool. "Bonite," 1852, Atlas, pl. 43, f. 5 and 6.

between the end of the fully retracted proboscis and the nerve-ring; further, this section issues from the proboscis, and is not attached along the inturned wall of it. This section of the œsophagus is not long enough to allow of any evagination, unless we are to suppose that in the proboscis it is coiled as in *Pyrula ficus*, and this, in view of the rather small diameter of the proboscis, seems unlikely. What looks like the anterior end of the "sac" and posterior end of the "sheath," is represented in the two figures referred to. If it be supposed that the rest of the sac had been cut away, the figures become explicable, and the absence of that portion of the proboscis which should be attached on the one hand to the inner end of sheath, and on the other to the posterior end of the proboscis would be explained.

Haller* has discussed *Melongena* ("*Pyrula*") *tuba*, but adds nothing to our knowledge of this part of the anatomy.

The length of the œsophagus depends on that of the proboscis, and is, therefore, not, *per se*, of comparative value from a systematic point of view.

Leiblin's gland in *Megalatractus* is particularly large; those of *Purpura lapillus* and *Jopas sertum*, as described by Amadrut,† appear to be nearly as large, whilst those of *Concholepas peruvianus*‡ and *Murex trunculus*§ are even larger. But from all those examples it differs in being lamelliform.

The stomach of *Melongena melongena*, Linn., so closely resembles that of *Megalatractus* that the two might almost be described in the same words. The following abstracts from Vanstone‖ supplement my own description:—"This organ is very small in proportion to the size of the animal's body. . . The calibre of this organ is but slightly in excess of that of the œsophagus and intestine, and in this it differs from *M. tuba*, in which the stomach is more expanded and sac-like.

"The chief point of interest, however, is not seen until the stomach is opened, and, if present in *M. tuba*, was overlooked by Souleyet. Within the stomach of *M. melongena*, on the upper and lower walls, there is a longitudinal series of hard cuticular plates and knobs lineally disposed on a median ridge."

In *Megalatractus* there are numerous narrow, longitudinal lamellæ in the stomach, as well as the two rows of knobs; these are not mentioned by Vanstone as occurring in *M. melongena*, nor does he show them in his fig. 4, which otherwise represents the stomach of our genus.

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* Haller—Morph. Jarb., xiv., 1888, pp. 158-162.
† Amadrut—*Loc. cit.*, pp. 243 and 246.
‡ Haller—*Loc. cit.*, fig. 1.
§ Haller—*Loc. cit.*, fig. 9.
‖ Vanstone—Linn. Soc. Journ., Zool., xxiv., 1893, p. 370.

Vanstone only mentions one "bile" duct, whereas in *Megalatractus* there are two. In the two species of *Fusus* described by Haller,* there are two ducts, but they are fused into one near the stomach, so that there is only the one orifice.†

I know of no extended description of the vascular system of a Gastropod with which one may compare the present. Perrier's valuable memoir—"Sur l'anatomie et l'histologie du rein des Gastéropodes Prosobranches"‡—has given to us details of the vascular system affecting the nephridium of the numerous types he studied. The earlier memoir by Haller§ is not so extensive, and I have, therefore, confined my comparison to that of the French writer.

The arrangement and origin of the nephridial veins in *Megalatractus* do not find an exact parallel in any of Perrier's examples, yet, on page 156, he gives the following general definition which includes our example. The definition is in section v.: "Rein proprement dit. Son irrigation.—Sur la surface libre de cette masse spongieuse se voint presque partout des *vaisseaux sanguins*, abondamment ramifiés, et constituant un réseau vasculaire de la plus grande richesse. Ces vaisseaux naissent d'un ou de plusieurs troncs, dont les principaux partent du sinus abdominal antérieur, que nous avons vu exister près du rectum.

"D'autres branches de moindre importance peuvent venir des autres sinus veineux, soit de la masse viscéral du tortillon, soit de la cavité générale anterieure. . . .

"Ce réseau intérieur de vaisseaux constitute le *système afférent* du rein, comme pemettent de la conclure ses connexions avec les sinus de la cavité générale."

He then (p. 157) proceeds to describe the *efferent veins*. This part of the definition, however, is not applicable, no efferent veins of the type he describes being present in our first species. The nephridium was in a sufficiently good state of preservation to allow me to speak definitely on this point.

The form of the nephridium, and the arrangement of the afferent veins on its internal surface in *Buccinum*, resemble closely what has been found in *Megalatractus*, but the origin of the veins differs. The following is Perrier's‖ description of the afferent system:—

"Comme toujours, dans le voisinage du rectum, et du péricarde se trouve un vast sinus sanguin, faisant communiquer la cavité générale du corps proprement dit avec les lacunes de la masse viscéral du tortillon. C'est de ce sinus, le sinus abdominal

* Haller—*Loc. cit.*, p. 161.
† Haller—*Loc. cit.*, figs. 18 and 20B.
‡ Perrier—Ann. Sci. Nat., (7), viii., 1889.
§ Haller—Morph. Jarb., xi., 1886.
‖ Perrier—*Loc. cit.*, pp. 252-3.

antérieur, que partent les vaisseaux destinés à irriguer l'appareil urinaire."

(Page 255):—"L'irrigation de celui-ci [the accessory system] est elle-même tres particulière. Du même sinus abdominal antérieur qui donne naissance aux vaisseaux du rein, part, à la partie antérieure, un dernier vaisseau, qui à lui seul distribue le sang à tout le second système rénal."

The points of difference are:—(1) That the vena-maxima, or "sinus abdominal antérieur," does not serve to place in communication the body cavity and lacunæ of the visceral coil, but places the latter in communication with the rectal sinus; (2) that the nephridial branch of the vena-cephalica, or "un dernier vaisseaux," etc., arises from the main trunk of the vena-cephalica, and not from the vena-maxima.

On page 246, Perrier describes in the Olividæ a structure resembling the ureter of *M. aruanus*.

The nephridial gland apparently is of the same shape, and occupies the same position in *Buccinum* as it does in *Megalatractus*; but Perrier's* description is a general one applied to several examples, and one comes to this conclusion from a study of his figures (59 and 61, to 64), as well as a perusal of his description.

The nervous systems of all the genera ranged by Bouvier† under his group "Stenoglosses" are of the same concentrated character as that here described. The following four systems resemble that of *Megalatractus*. They are arranged in the order of their resemblance:—

Purpura persica, Lamk. (Haller).‡
Voluta ancilla, Solander (Woodward).§
Voluta neptunei, Gmelin. (Bouvier).‖
Fusus syracusanus, Linn. (Haller).¶

All four systems differ from that under consideration in having very short cerebro-buccal commissures, and with this exception the figures and descriptions of the first two of the above systems apply almost perfectly to our genus. The third system differs not only in the length of the cerebro-buccal commissures, but also in the less degree of concrescence of cerebral, pleural, and pedal commissures and the better differentiation of each cerebral ganglion from the other. The last system, which we might have expected to most closely resemble that of *Megalatractus*, adds to

* Perrier—*Loc. cit.*, p. 251.
† Bouvier—Ann. Sci. Nat., (7), iii., 1887.
‡ Haller—Morph. Jarb., xiv., 1888, pp. 147-149, pl. v., f. 56 and 57.
§ Woodward—Proc. Malac. Soc. Lond., iv., 3, 1900, pp. 117-125, pl. x.
‖ Bouvier—*Loc. cit.*, pp. 301-306, f. 74-75.
¶ Haller—*Loc. cit.*, pp. 158-159, f. 35.

the differences itemised under the last a better differentiation of the left cerebral ganglion, not only from the sub-intestinal ganglion, but also from its own cerebral and pedal commissures.

In the character that this system differs from the four mentioned above, viz., the increase in length of the cerebro-buccal commissures, it seems to agree with that of *Melongena ("Pyrula") tuba*, Lamk. Souleyet* has figured and described two long nerves, arising from the cerebral ganglion and terminating under the buccal mass, which may be justly regarded as cerebro-buccal commissures. Unfortunately, as noted by Bouvier,† Souleyet's figure of the centre of the nervous system of *M. tuba* is "very difficult to interpret," so that one cannot compare the rest of the two systems.

With the first two of the above four nervous systems, I might have bracketed those of *Fulgar perversum*, Linn., and *Chrysodomus contraria*, Linn., as described and figured by Fischer and Bouvier,‡ were it not that they are of sinistral mollusca, and therefore turned left for right.

From what is known of the reproductive systems of *Megalatractus*, they resemble those of *Melongena ("Pyrula") tuba*, Lamk., as described by Souleyet, in essential characters; an unimportant difference is found in the absence from Souleyet's example, of the coiling of the vas-deferens on the surface of the digestive gland.

"The plan of construction of this ovisac (that of *M. aruanus*) somewhat corresponds to that of *Pirula (Sycotypus) canaliculata*, Linn., figured by Fischer."§ (Hedley.‖)

VI.—THE SYSTEMATIC ALLOCATION OF THE GENUS.

Throughout the last section of this paper it will have been noticed that the various organs and systems of organs have been more satisfactorily compared with those of *Melongena* than those of other genera. This repeated resemblance will have forestalled the present section, for it has become obvious as the concluding portion of the section was reached that *Megalatractus* is closely allied to *Melongena*, or *Semifusus;* it therefore occupies a position in the family Turbinellidæ, Fischer.¶

This conclusion is another testimonial to the wonderful ability of Dr. Paul Fischer to seize upon the salient points of a shell

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* Souleyet—Zool. "Bonite," iii., 1852, p. 618, Atlas, pl. 43, f. 8 and 9.

† Bouvier—Ann. Sci. Nat. (7), iii. 1887, p. 254.

‡ Fischer and Bouvier—Journ. de Conch., (3), xxxii., 1892, p. 150, pls. i. and ii.

§ Fischer—Man. Conch., 1887, p. 92.

‖ Hedley—Proc. Linn. Soc. N.S. Wales, xxv., 1900, p. 508.

¶ Fischer—Man. Conch., 1887, pp. 618-623.

when assigning it a systematic position. He regarded *Megalatractus* as a subgenus of *Semifusus*. It is, however, worthy of full generic rank; the absence of a snout is alone worthy of such recognition.

The names *Melongena* and *Semifusus* seem to be applied indifferently by different writers to most of the species that have been assigned to either; are they both valid and useful genera?

In his paper on the Prosobranchs of the "Vettor Pisani," so many times referred to already, Haller* describes the anatomy of a *Fusus proboscidiferus*, Lamk. (or in the explanation of plates "*proboscideus*.") Now, the only mollusc which I can find to have ever been known by that name is the one which I have here described as *Megalatractus aruanus*, yet that which Haller described is certainly not the same as my example, as the most casual examination of his figures and mine will suffice to show. The explanation of this confusion lies in the facts that Linneus described two species under the name of *M. aruanus*, an American, and an Australian. Lamarck subsequently named the Australian species *Fusus proboscidiferus*, whilst the American species had already been designated *Murex carica* by Gmelin. There were then three names to the two species, and it seems possible that Dr. O. Boettger adopted Lamarck's name and short description to the American species now known as *Fulgur carica*, Gmel. Had Dr. Boettger's systematic and geographic account of the "Vettor Pisani" collection been published† it would have been possible to identify Haller's "*Fusus proboscidiferus*, Lam." As it is, we must rest content with the above suggestion till *F. carica* is again anatomically examined.

Haller's sentence,‡ "Der Rüssel der Fusiden ist bekanntlich sehr lang und bei F. proboscidiferus, wo er wohl die grösste Länge erreicht, diente er Lamarck sogar zur Benennung der Art," is altogether without foundation, for Lamarck§ said of the species—"Ce fuseau est extrêmement remaquable par la partie supérieure de la spire qui ressemble à une trompe droite, comme implantée et terminale," and it was doubtless this feature which suggested to him the specific name.

There is another case of slight doubt which must be drawn attention to, and this time in the work of a French writer, and this is rather surprising, for the French writers err rather on the side of too much historical detail than too little. Amadrut‖ describes portion of the anatomy of a *P.* (*yrula*) *ficus* for which he quotes neither author nor specific description. Now

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* Haller—Morph. Jarb., xiv., 1888.
† Haller—Morph. Jarb., xiv., 1888, p. 55.
‡ Haller—*Loc. cit.*, p. 159.
§ Lamarck—Anim. s. Vert., vii., 1822, p. 126.
‖ Amadrut—Ann. Sci. Nat., (8), vii., 1898, p. 20.

there are two Prosobranchs to which this name has been given: one the *Bulla ficus*, Linnæus,* a Taenioglossate, the other the *Murex ficus*, Gmelin,† a Rachiglossate. I have concluded that he referred to the Linnean species, because Gmelin's is better known under another name, but the doubt still remains.

In view of this confusion and doubt about the above two species, I think I am justified in appealing to malacological anatomists to not only make certain that their material is correctly named, but also to give such references to figures and specific descriptions as will enable subsequent readers to satisfy themselves of that point also. This is particularly necessary in view of the unsettled state of conchological nomenclature.

* Linnæus—Syst. Nat., edit. 12, p. 1184.
† Gmelin—Syst. Nat., edit. 13, p. 3545.

EXPLANATION OF PLATES.

Figures 1, 3, 4, and 6 of Plate xxxix., and 1 and 2 of Plate xli., are diagrammatic, and are not drawn absolutely to scale; it was desired to show the arrangement of the organs rather than their exact size; many drawings of Molluscan anatomy are rendered unintelligible through an unnecessary amount of detail in drawing the dissections as they are seen. The rest of the figures are absolutely to scale.

EXPLANATORY LETTERS.

an. anus.
ant. œs. anterior œsophagus.
ap. reno-pallial orifice.
ao. ce. aorta-cephalica.
ao. vis. aorta-visceralis.
aur. auricle.
br. n. branchial nerve.
c. buc. con. cerebro-buccal connective.
ce. g. cerebral ganglion.
col. mus. columella muscle.
col. n. columella nerve.
c. pl. pd. com. the fused cerebral, pleural and pedal commissures of the left side.
c. pd. com. cerebro-pedal commissure.
cten. ctenidium.
du. duct of Leiblin's gland.
gl. ut. glandular uterine wall showing through a break in the mantle.
gen. n. penis nerve (?).
go. ovary.
grv. mucous (?) groove.
hep. hepato-pancreas.
hep. du.' first; *hep. du."* second hepato-pancreatic duct.
int. intestine.
l. m. n. left mantle nerve.
l. pl. g. left pleural ganglion.
l. v. con. left visceral connective.
m. g. hypobranchial mucous gland.
m. p. metapodium.
neph. nephridium.
neph. gl. nephridial gland.
œs. cœ. œsophageal cæcum.
œs. gl. œsophageal gland.
op. operculigerous lobe of the foot.
osph. osphradium.
p. penis.
pb. proboscis.
pb. sac. proboscis-sac.
pb. sh. proboscis-sheath.
p. c. pericardium.
pd. g. pedal ganglia.
pl. pd. com. pleuro-pedal commissure.
p. mus. a strand of muscle attached to body wall and proboscis-sac.
post. œs. posterior œsophagus.
pr. pores leading to the nephridial gland.
r. m. n. right mantle nerve.
r. pl. g. right pleural ganglion.
r. v. con. right visceral connective.
rect. rectum.
rect. si. rectal sinus.
s. siphon.
sb. int. g. sub-intestinal ganglion.
sp. int. g. supra-intestinal ganglion.
stom. stomach.
tent. tentacles.
tent. lb. tentacle lobe.
ur. ureter.
ut. uterus.
v. ventricle.
v. d. vas-deferens.
ve. br. efferent branchial vein.
ve. ca. vena-cava.
ve. ce. vena-cephalica.
ve. ce. neph. nephridial branch of the vena-cephalica.
ve. ce. per. pericardial branch of the vena-cephalica.
ve. mx. vena-maxima.
ve. per. venæ pericardiales.

EXPLANATION OF PLATE I.

Gyropleurodus galeatus, Günther.

Jaws natural size (from a photograph).

EXPLANATION OF PLATE II.

Catulus analis, Ogilby.

Fig. 1.—Female, one-third natural size.

Parascyllium collare, Ramsay & Ogilby.

Fig. 2.—Male, three-fourths natural size.

Fig. 1.

Fig. 2.

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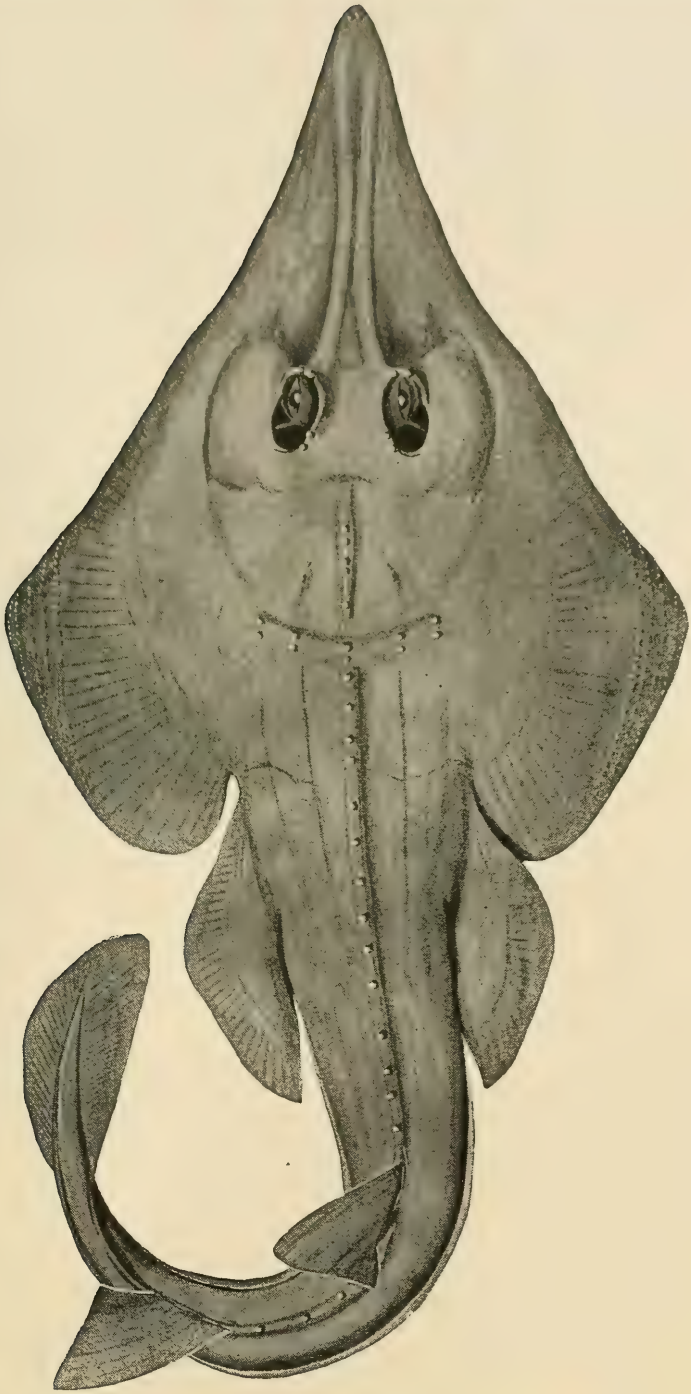
EXPLANATION OF PLATE III.

Rhinobatus banksii, Müller & Henle.

Female, less than half natural size.



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EXPLANATION OF PLATE IV.

Raja australis, Macleay.

Male, less than half natural size.

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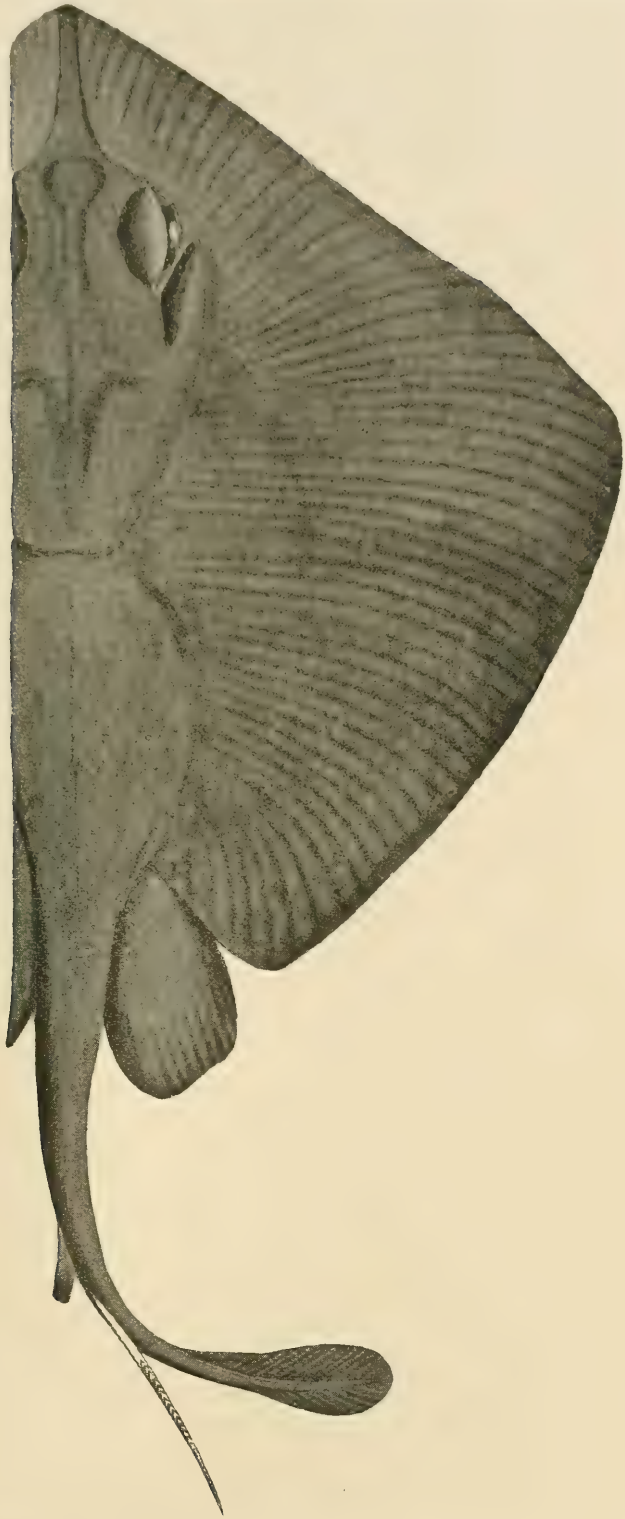
EXPLANATION OF PLATE V.

Trygonoptera bucculenta, Macleay.

Two-fifths natural size.



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EXPLANATION OF PLATE VI.

Chimæra ogilbyi, Waite.

Female, two-thirds natural size.

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EXPLANATION OF PLATE VII.

Macrorhamphosus scolopax, Linnæus, var. *elevatus*, Waite.

Fig. 1.—Natural size.

Macrorhamphosus gracilis, Lowe.

Fig. 2.—Natural size.

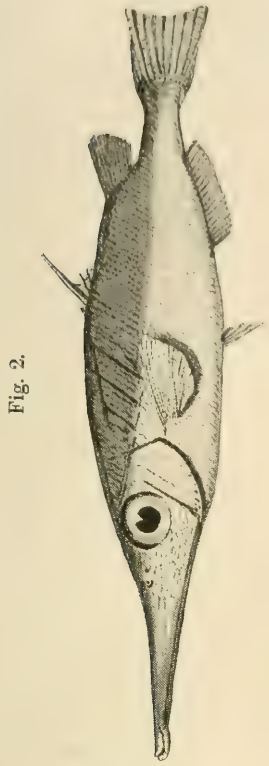

Fig. 2.

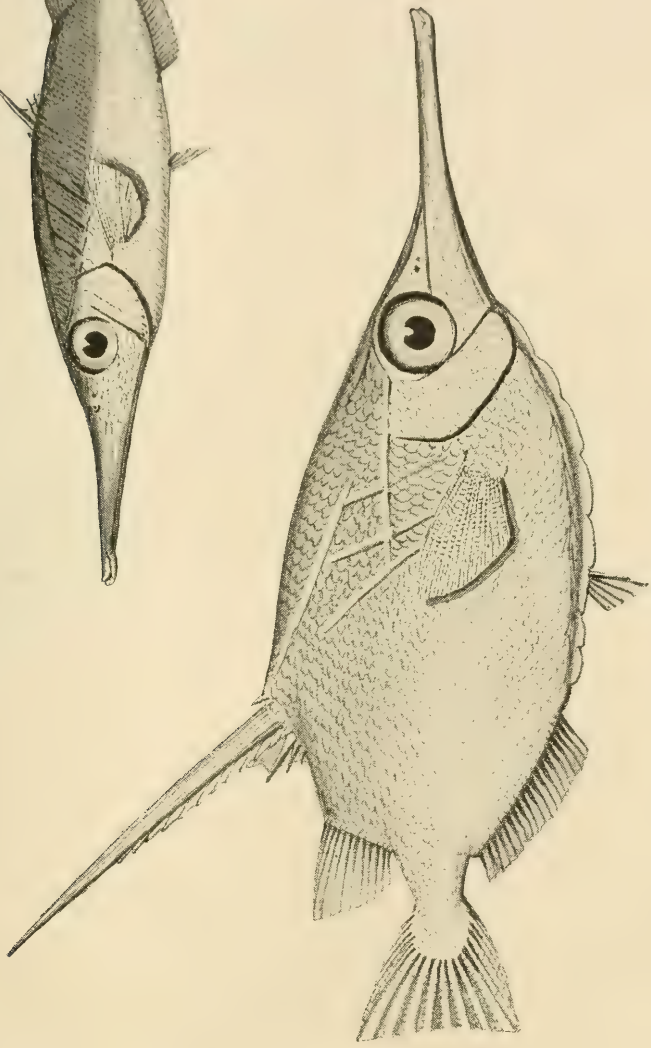

Fig. 1.

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EXPLANATION OF PLATE VIII.

Monocentris gloria-maris, De Vis.

Figs. 1 and 2.—Front and profile of head, natural size.

Monocentris japonicus, Houttuyn.

Figs. 3 and 4.—Front and profile of head, natural size.

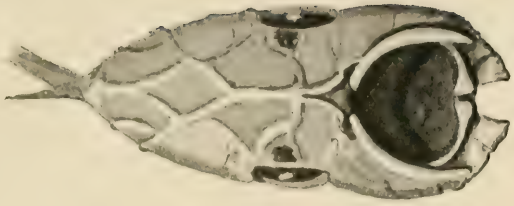


Fig. 4.

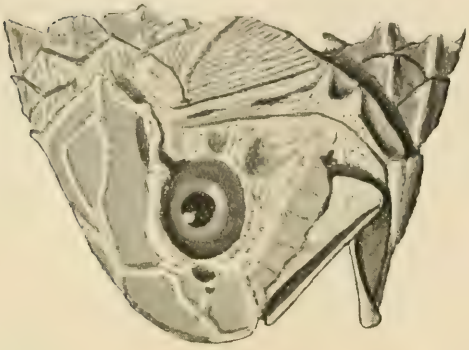


Fig. 3.

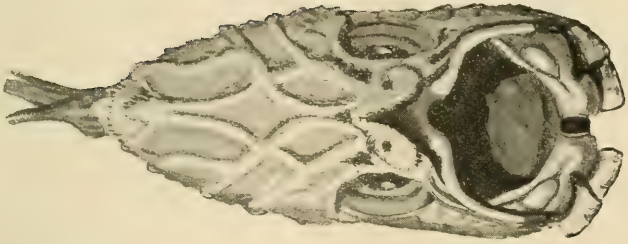


Fig. 2.

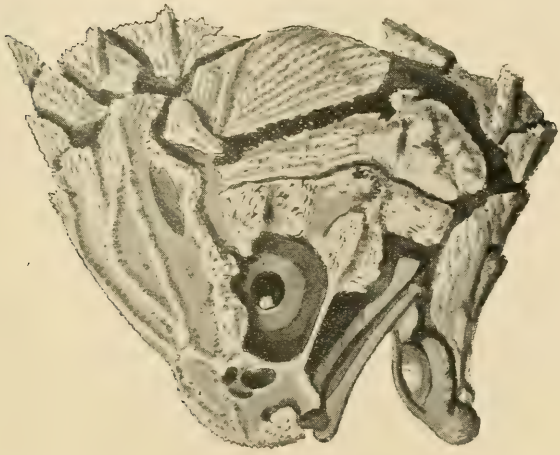
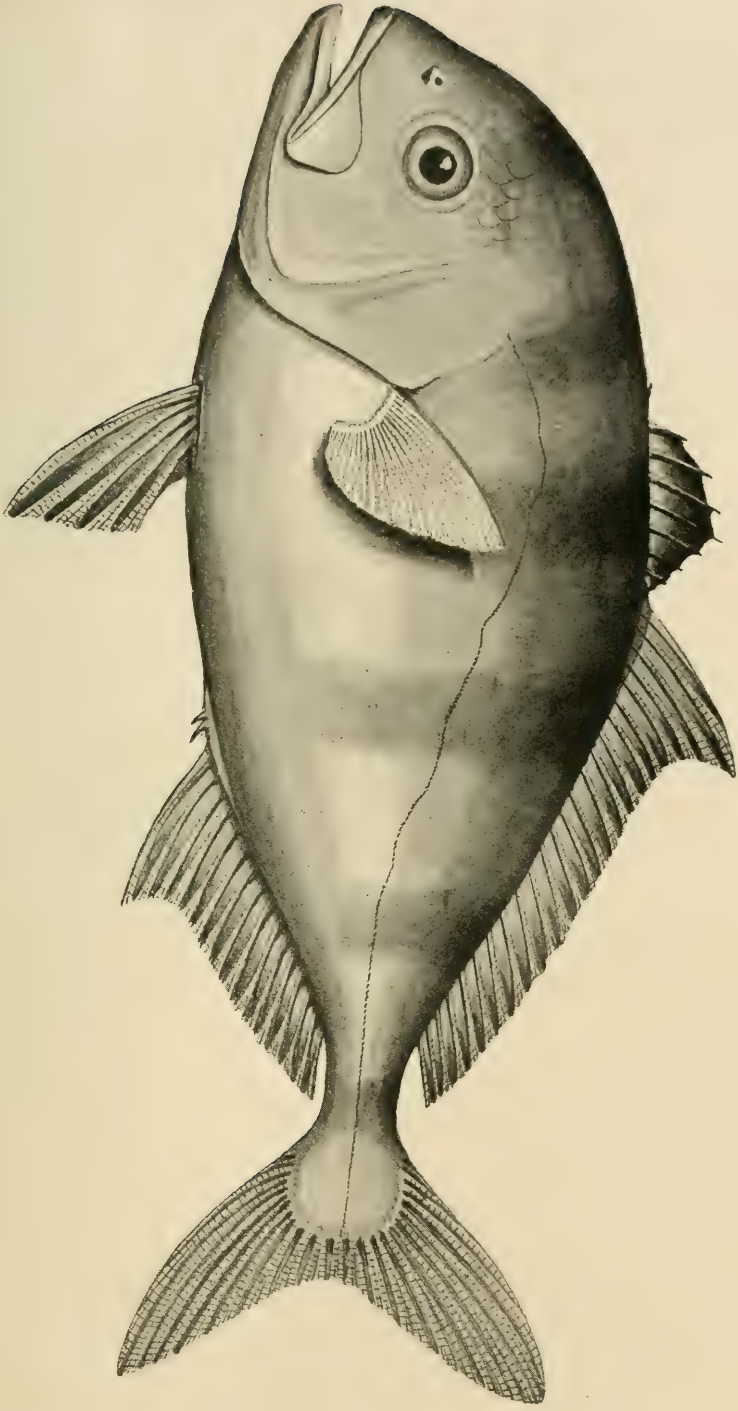


Fig. 1.

EXPLANATION OF PLATE IX.

Seriola hippos, Günther.

Young, natural size.



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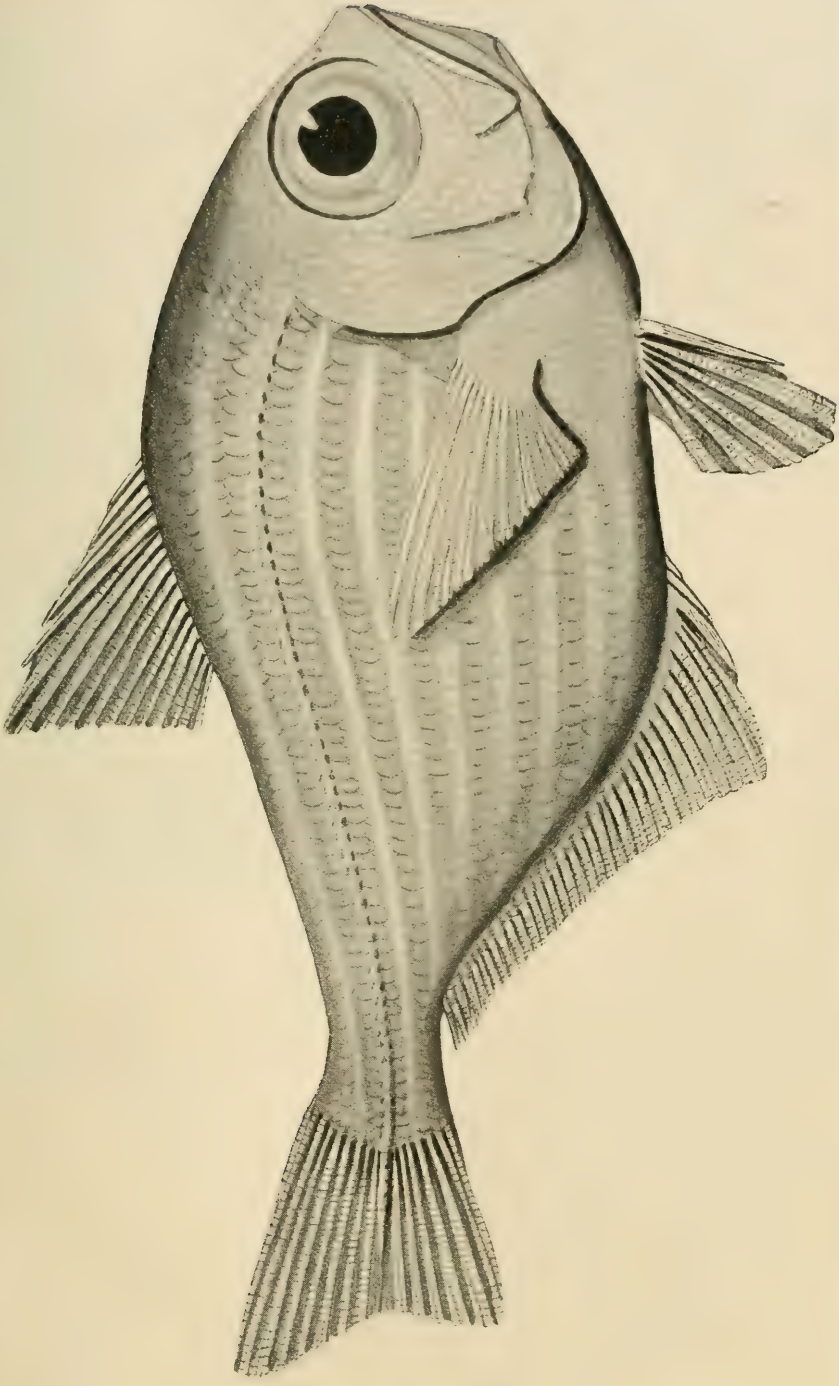
EXPLANATION OF PLATE X.

Pempheris macrolepis, Macleay.

Natural size.



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EXPLANATION OF PLATE XI.

Apogonops anomalus, Ogilby.

Fig. 1.—Natural size.

Centropercis nudivittis, Ogilby.

Fig. 2.—Natural size.

Cristiceps argyropleura, Kner.

Fig. 3.—Natural size.

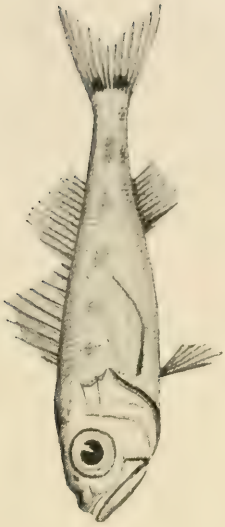


Fig. 1.

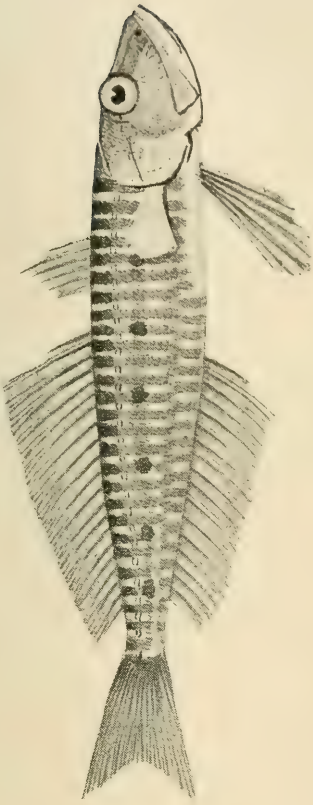


Fig. 2.

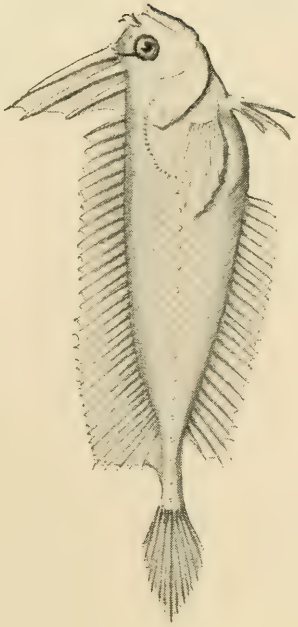
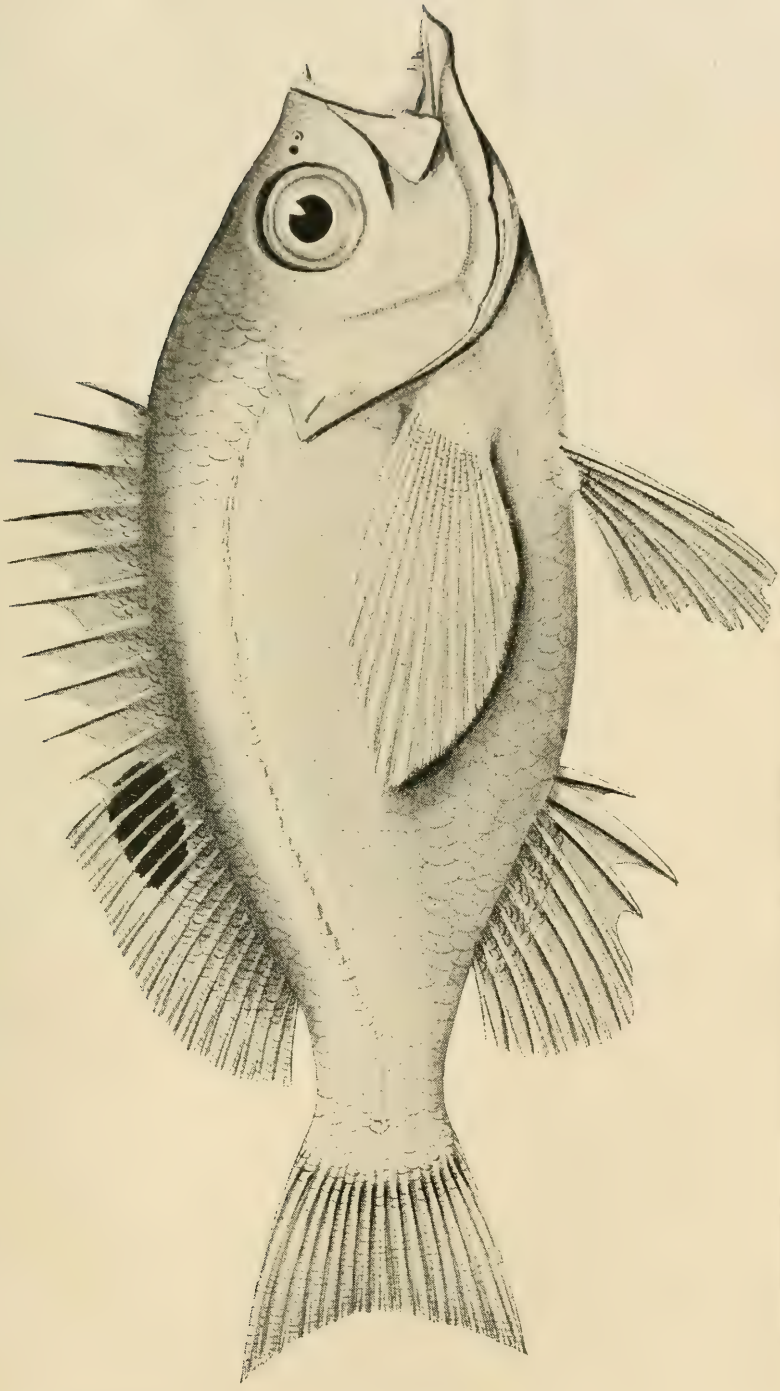


Fig. 3.

EXPLANATION OF PLATE XII.

Anthias pulchellus, Waite.

Four-fifths natural size.

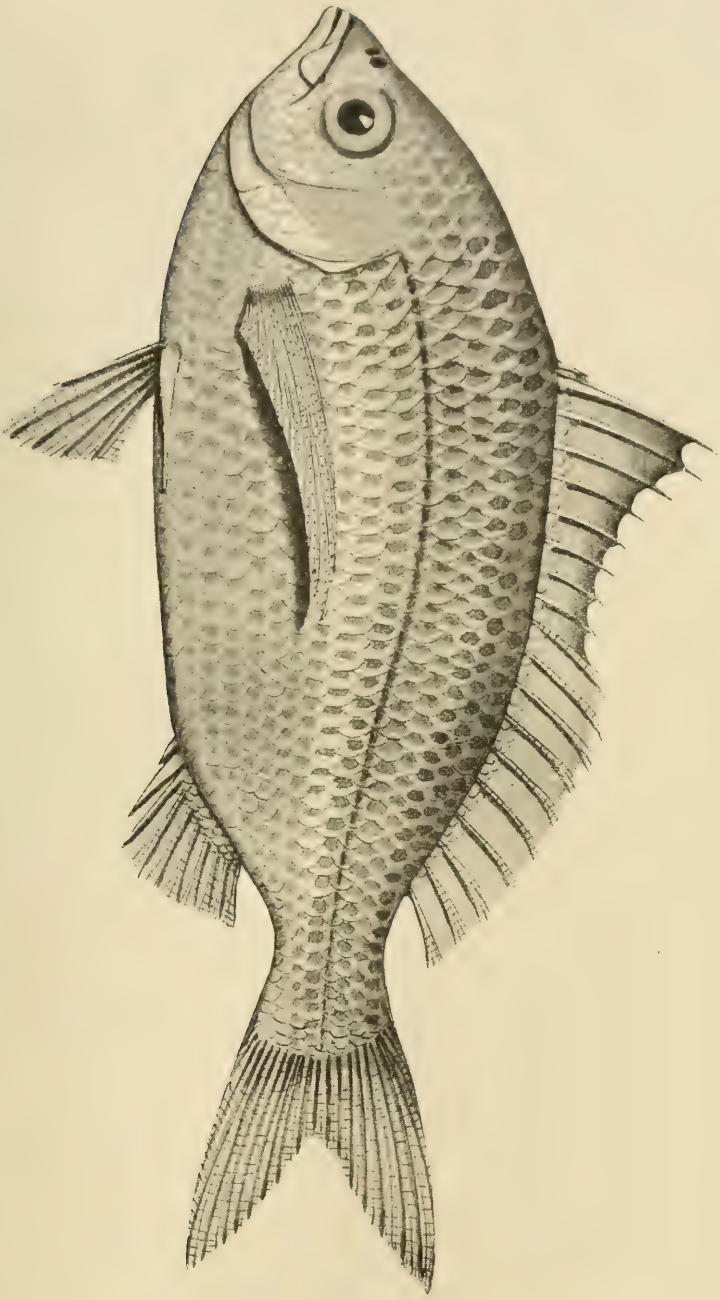


EDGAR R. WAITE, Del. AUST. MUS.

EXPLANATION OF PLATE XIII.

Xystœma ovatum, Günther.

Natural size.

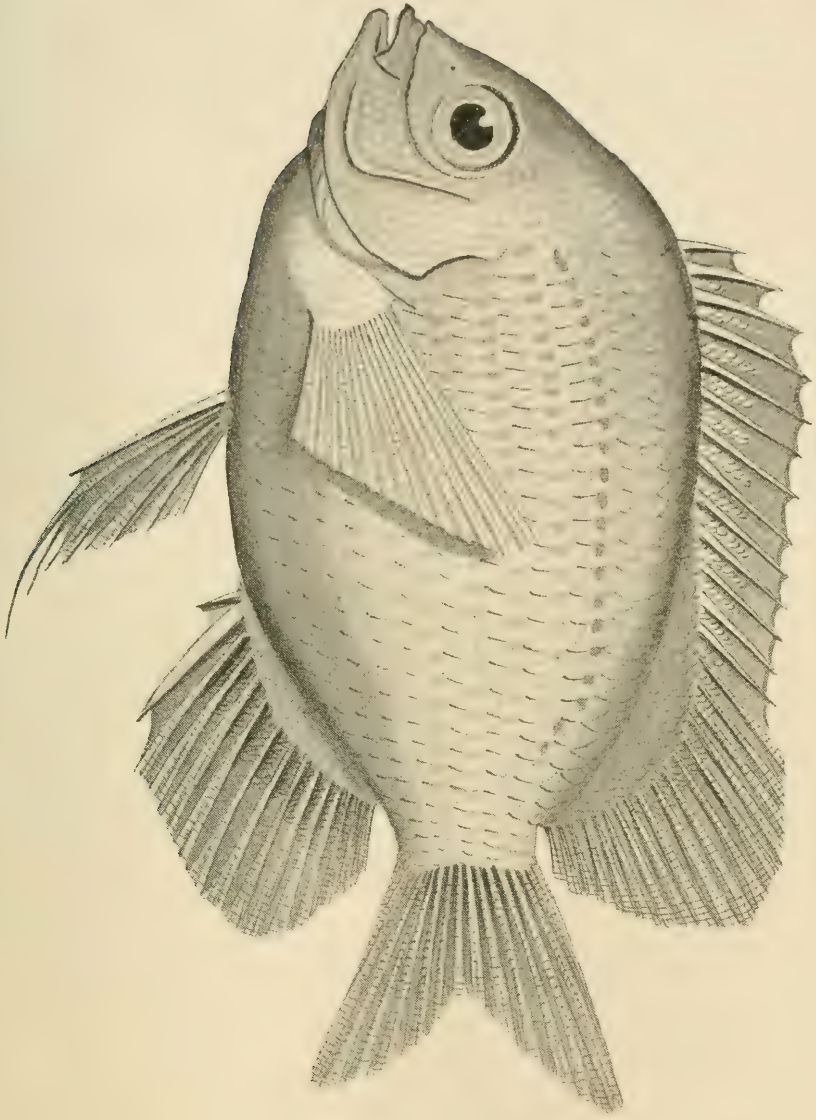


EDGAR R. WAITE, Del. AUST. MUS.

EXPLANATION OF PLATE XIV.

Heliases immaculatus, Ogilby.

Natural size.

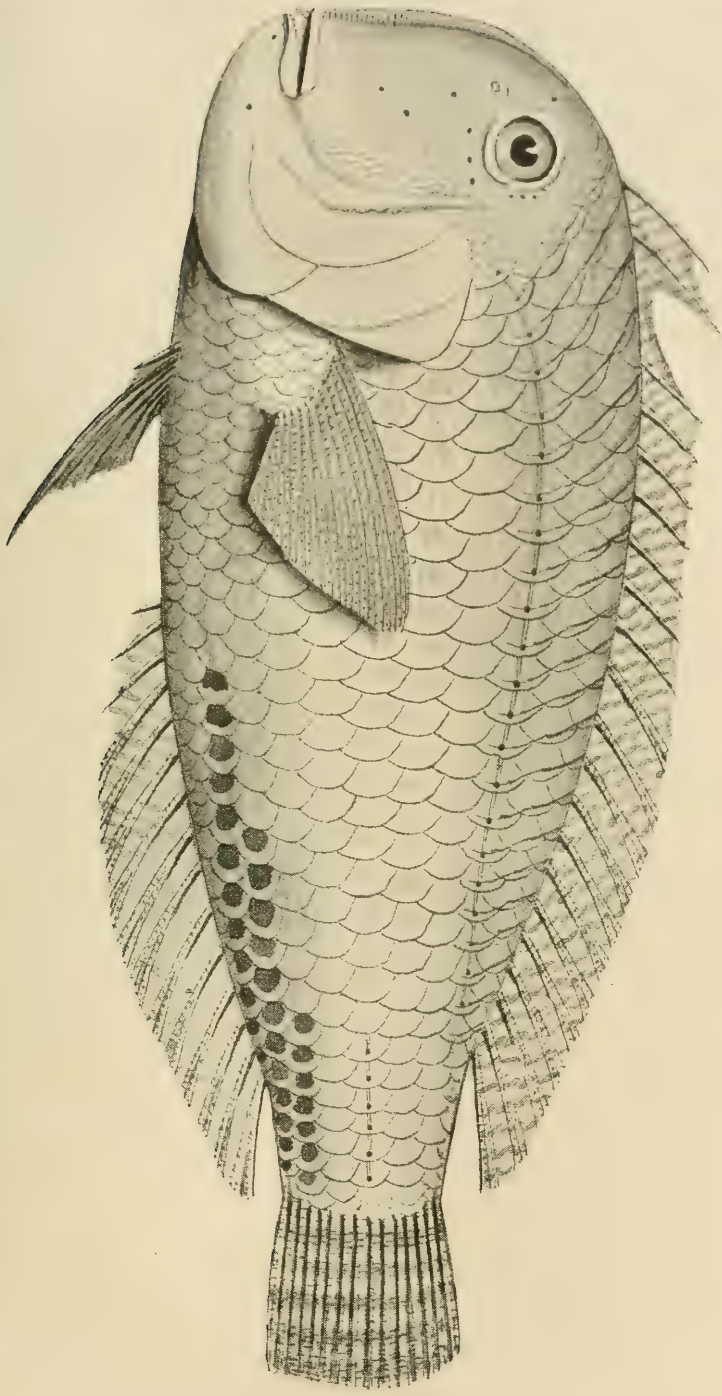


EDGAR R. WAITE, Del. AUST. MUS.

EXPLANATION OF PLATE XV.

Novaculichthys jacksonensis, Ramsay.

Natural size.

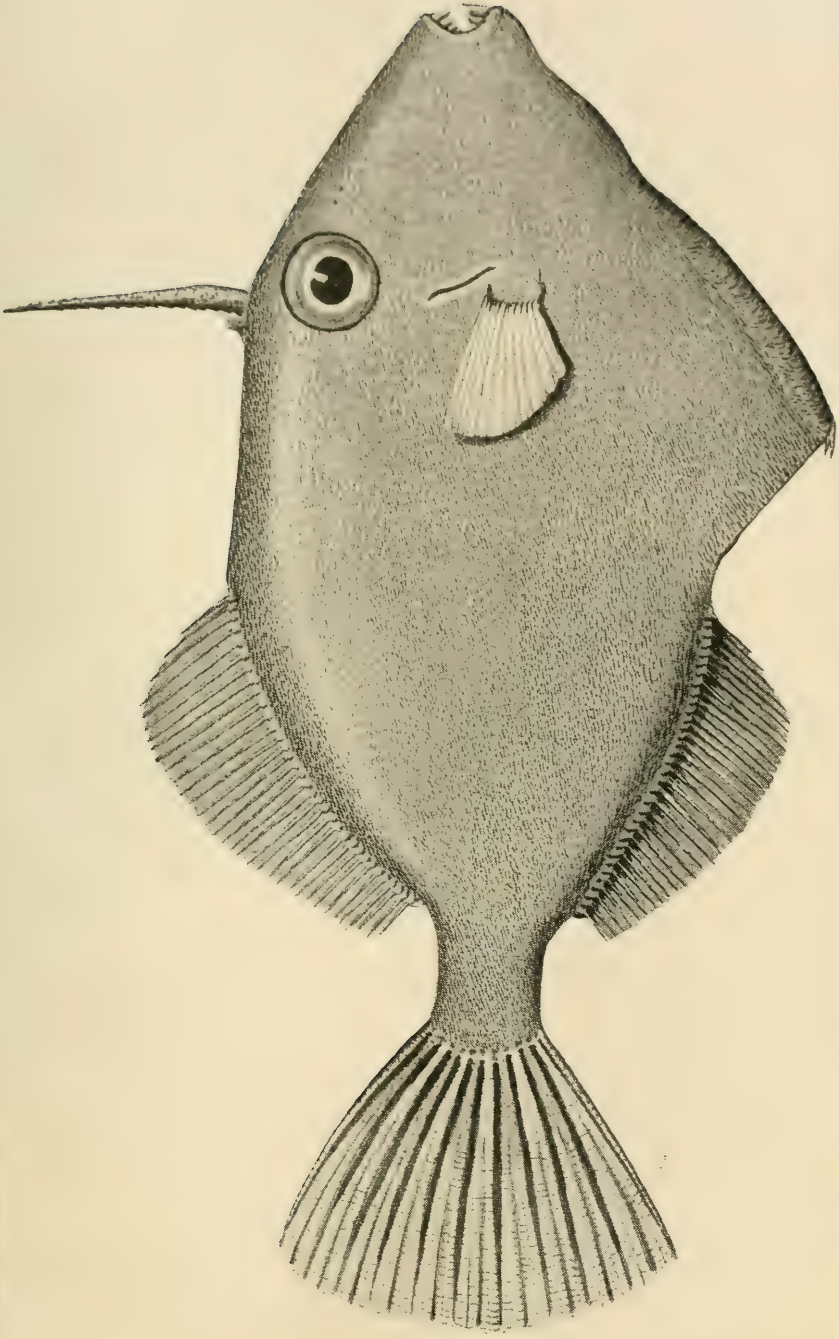


EDGAR R. WAITE, Del. AUST. MUS.

EXPLANATION OF PLATE XVI.

Monacanthus setosus, Waite.

Six-sevenths natural size.



EDGAR R. WAITE, Del. AUST MUS.

EXPLANATION OF PLATE XVII.

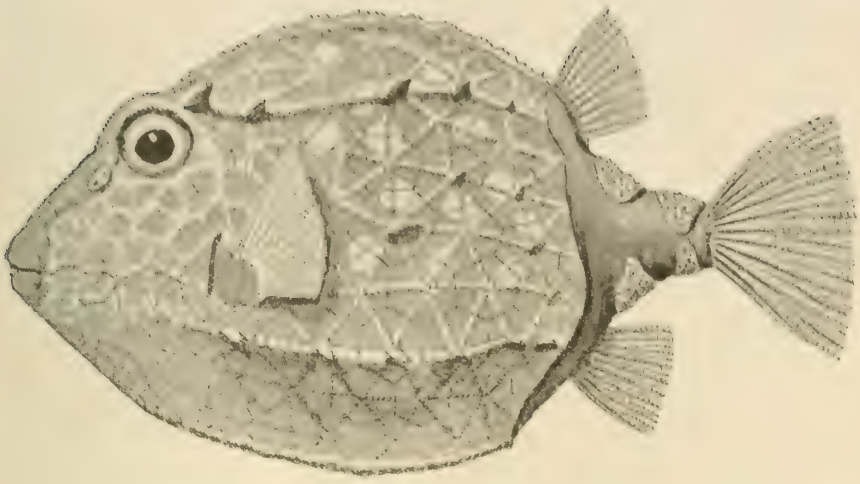
Monacanthus mosaicus, Ramsay and Ogilby.

Fig. 1.—Young, natural size.

Aracana lenticularis, Richardson.

Fig. 2.—Young, natural size.

Fig. 2.



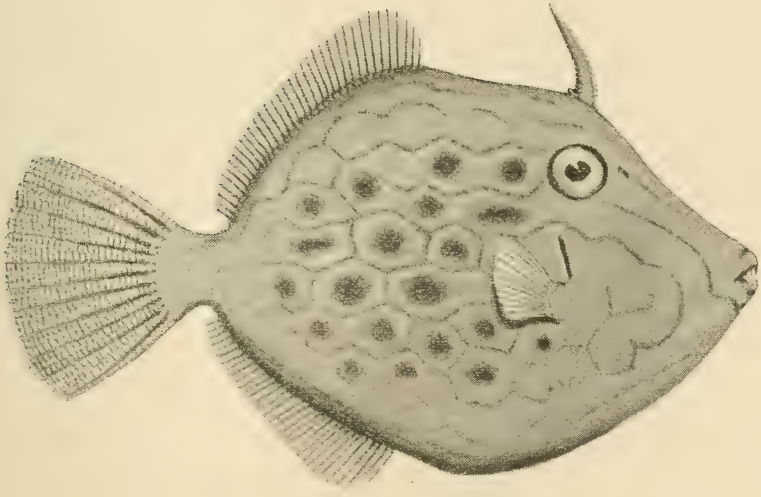
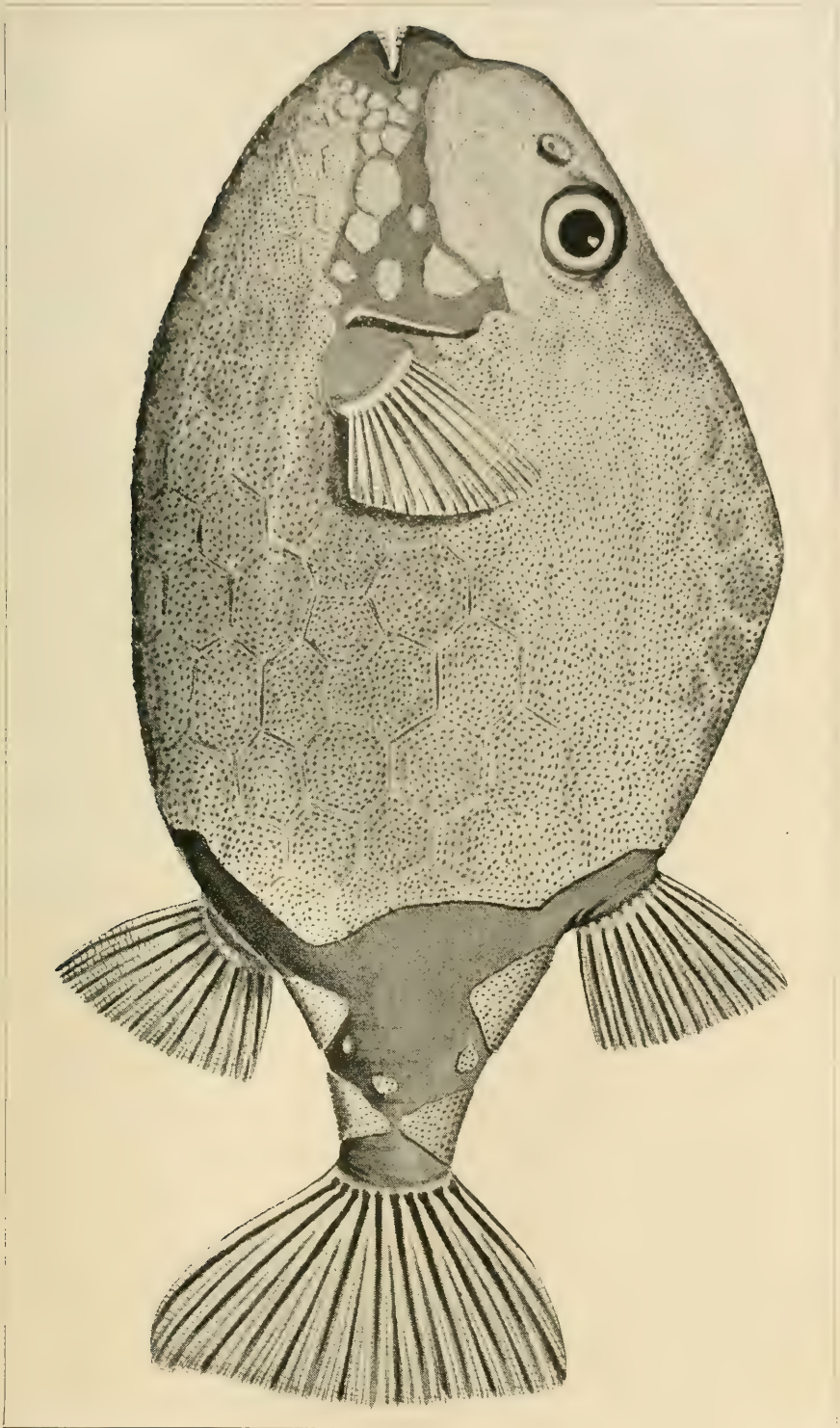


Fig. 1.

EXPLANATION OF PLATE XVIII.

Aracana lenticularis, Richardson.

Adult, three-fourths natural size.



EDGAR R. WAITE, Del. AUST. MUS.

EXPLANATION OF PLATE XIX.

Dicotylichthys punctulatus, Kaup.

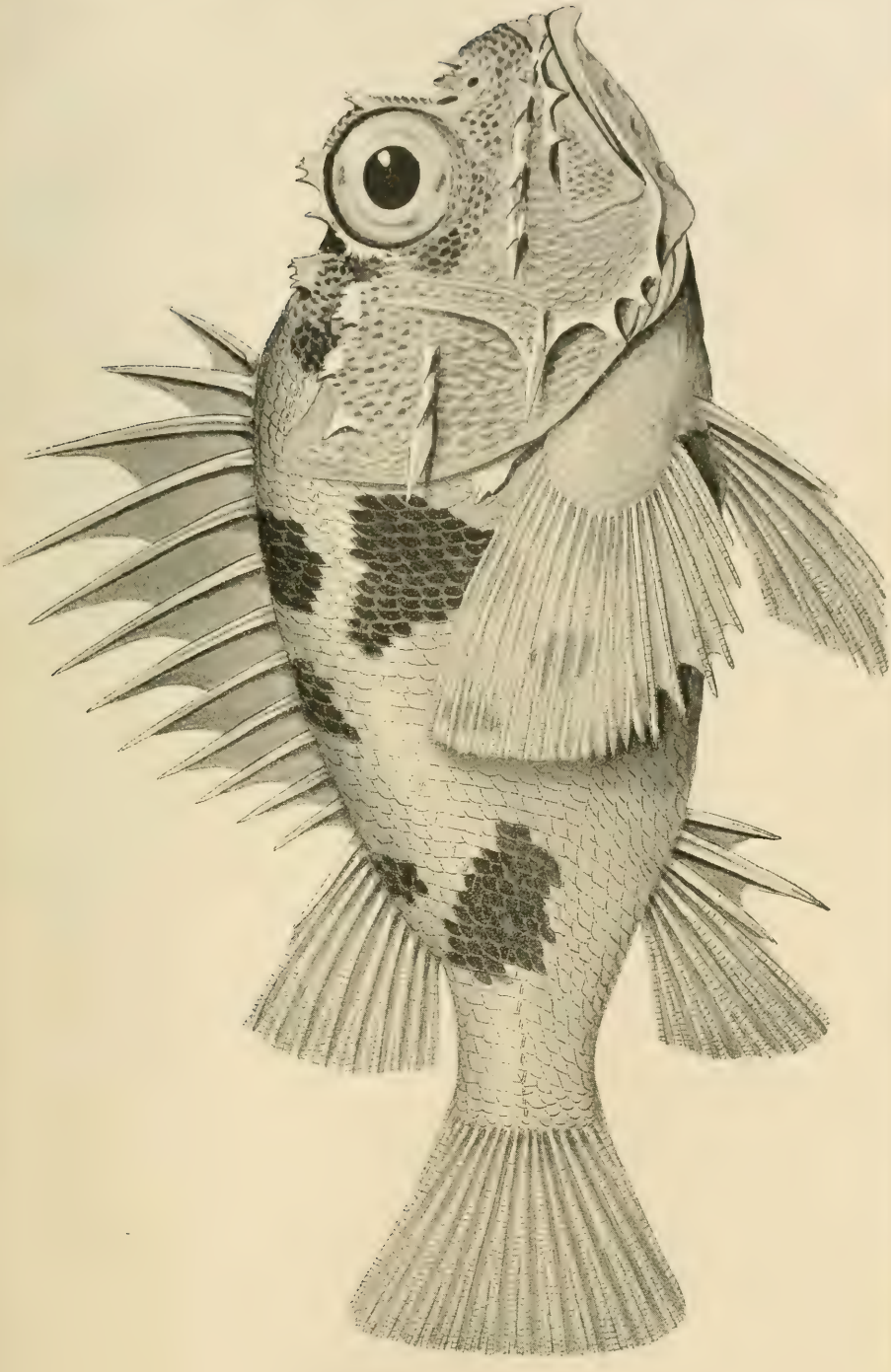
Two-thirds natural size.

EDGAR R. WAITE, Del. AUST. MUS.

EXPLANATION OF PLATE XX.

Sebastes thetidis, Waite.

Two-thirds natural size.

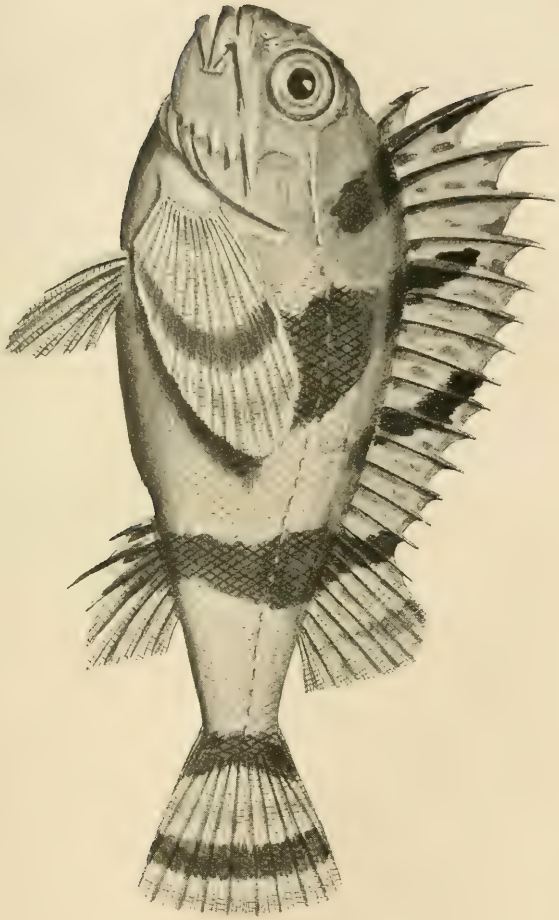


EDGAR R. WAITE, Del. AUST. MUS.

EXPLANATION OF PLATE XXI.

Neosebastes australis, White.

Natural size.

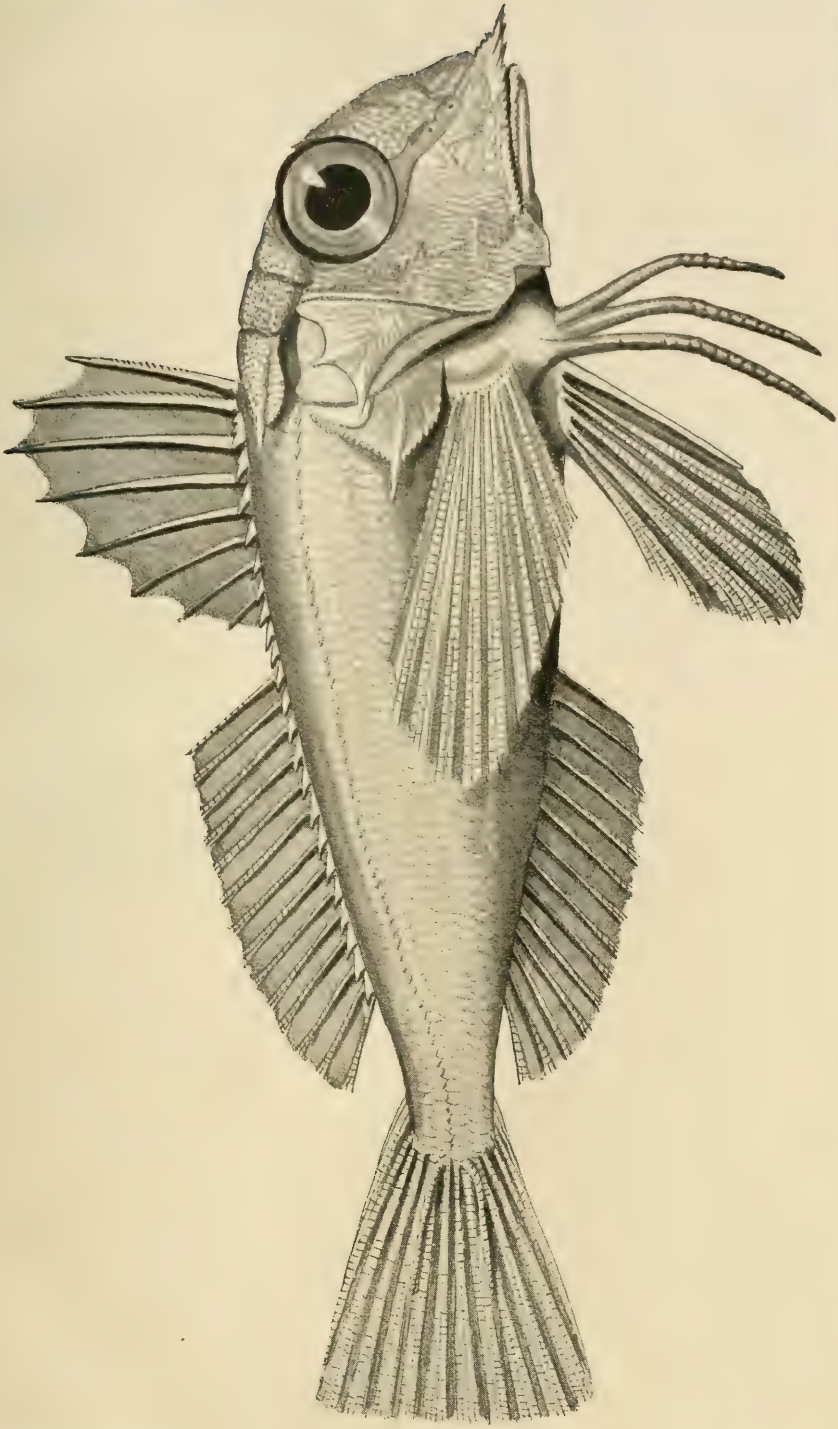


EDGAR R. WAITE, Del. AUST. MUS.

EXPLANATION OF PLATE XXII.

Lepidotrigla mulhalli, Macleay.

Natural size.

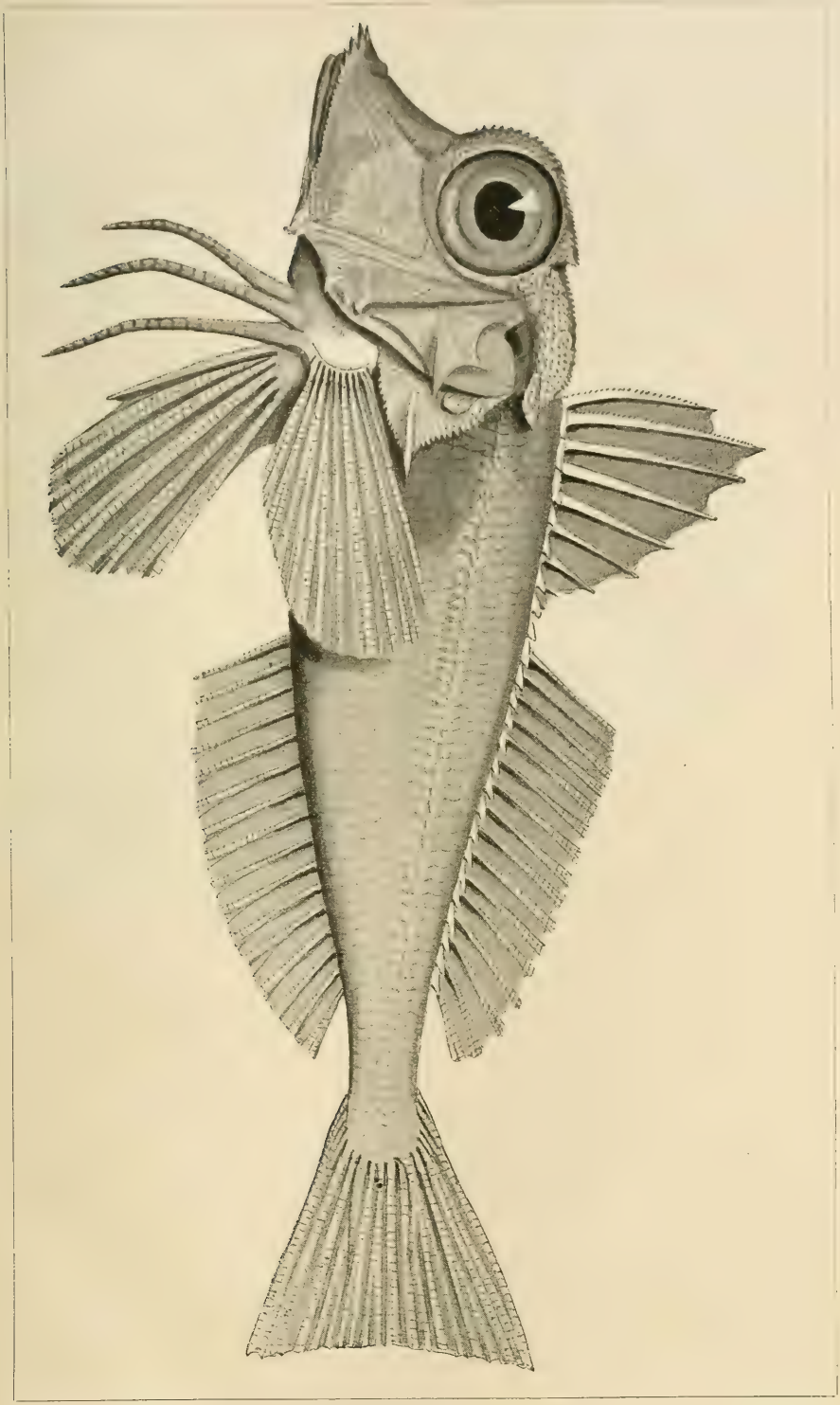


EDGAR R. WAITE, Del. AUST MUS.

EXPLANATION OF PLATE XXIII.

Lepidotrigla modesta, Waite.

Natural size.

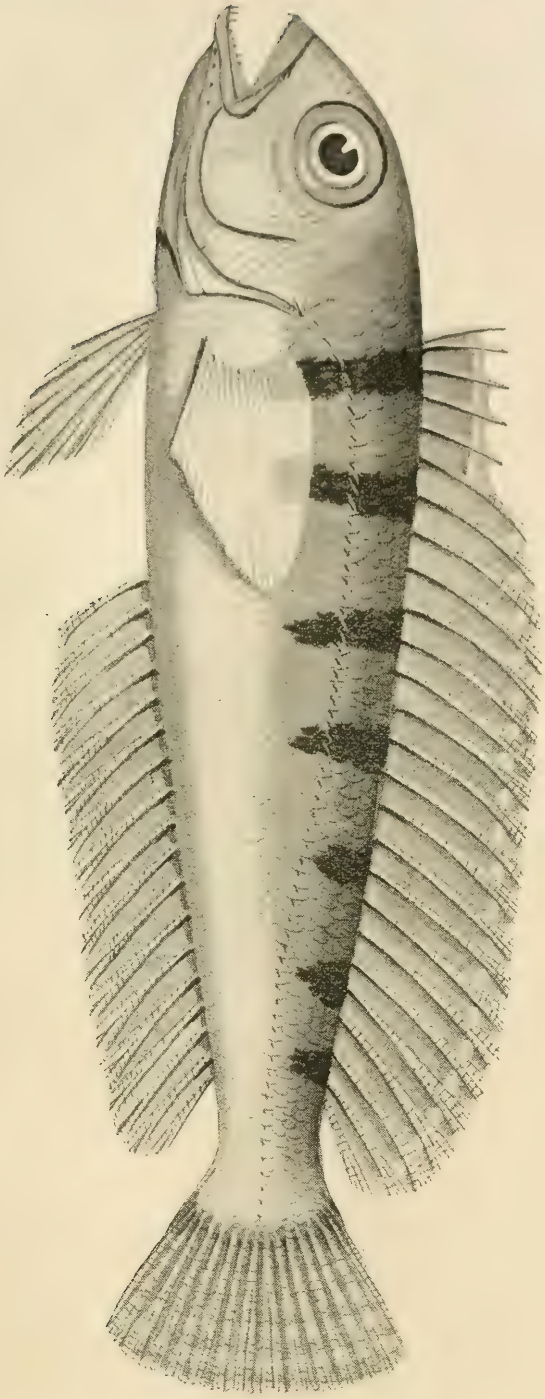


EDGAR R. WAITE, Del. AUST. MUS.

EXPLANATION OF PLATE XXIV.

Parapercis ocularis, Waite.

Natural size.

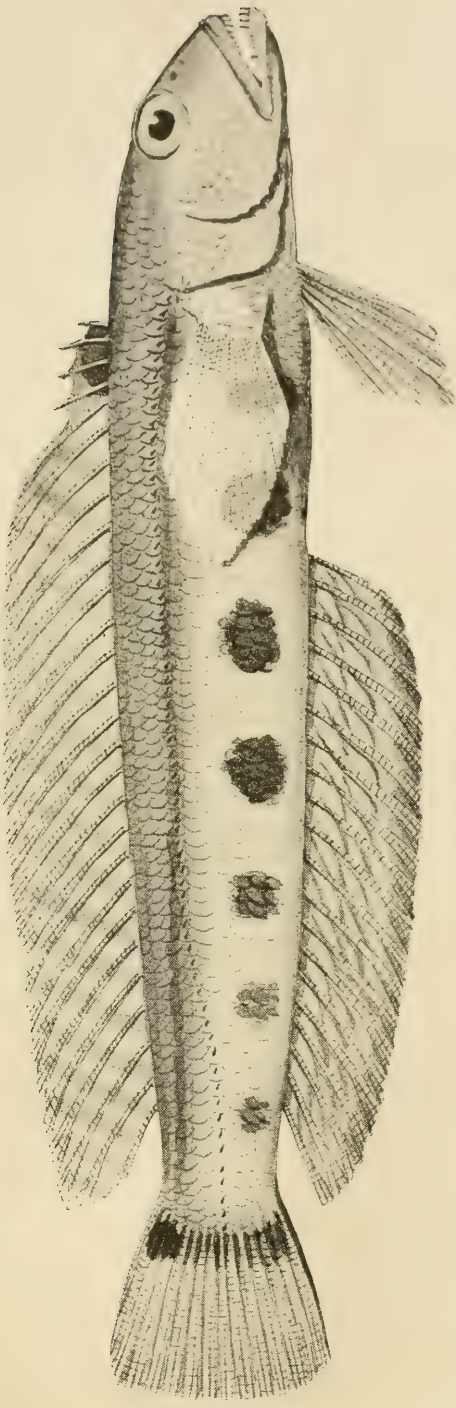


EDGAR R. WAITE, Del. AUST. MUS.

EXPLANATION OF PLATE XXV.

Parapercis novæ-cambriæ, Ogilby.

Nine-tenths natural size.

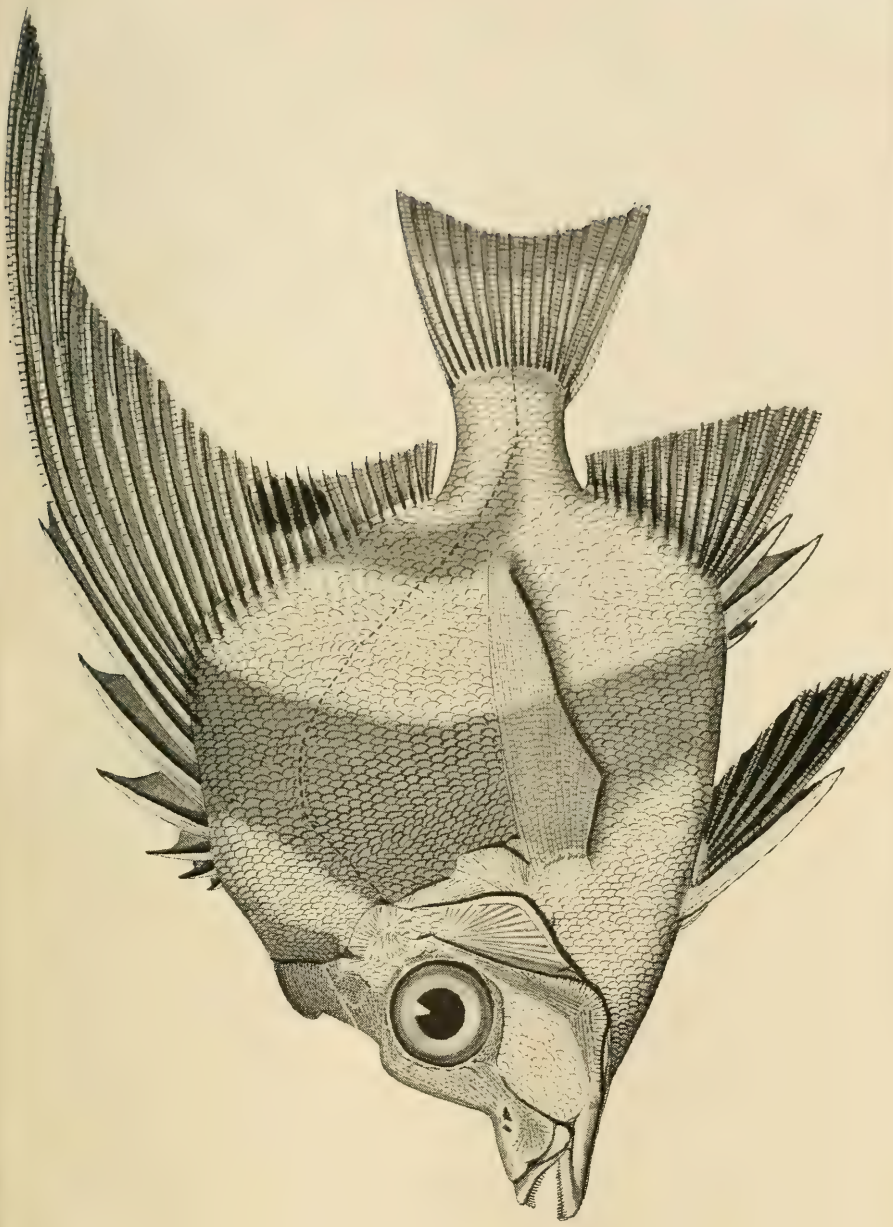


EDGAR R. WAITE, Del. AUST. MUS.

EXPLANATION OF PLATE XXVI.

Histiopterus elevatus, Ramsay and Ogilby.

Three-fourths natural size.



EDGAR R. WAITE, Del. AUST. MUS.

EXPLANATION OF PLATE XXVII.

Histiopterus farnelli, Waite.

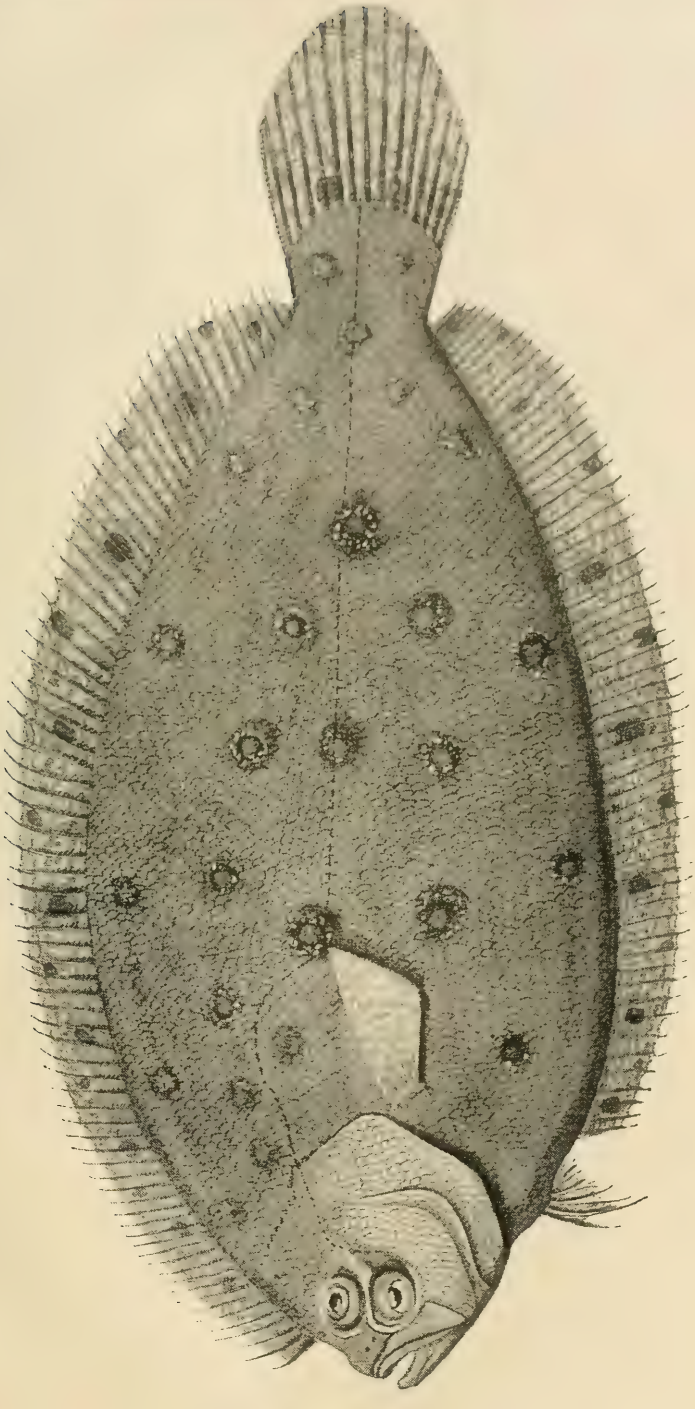
Seven-eighths natural size.

EDGAR R. WAITE, Del. AUST MUS.

EXPLANATION OF PLATE XXVIII.

Paralichthys tenuirastrum, Waite.

Five-sevenths natural size.

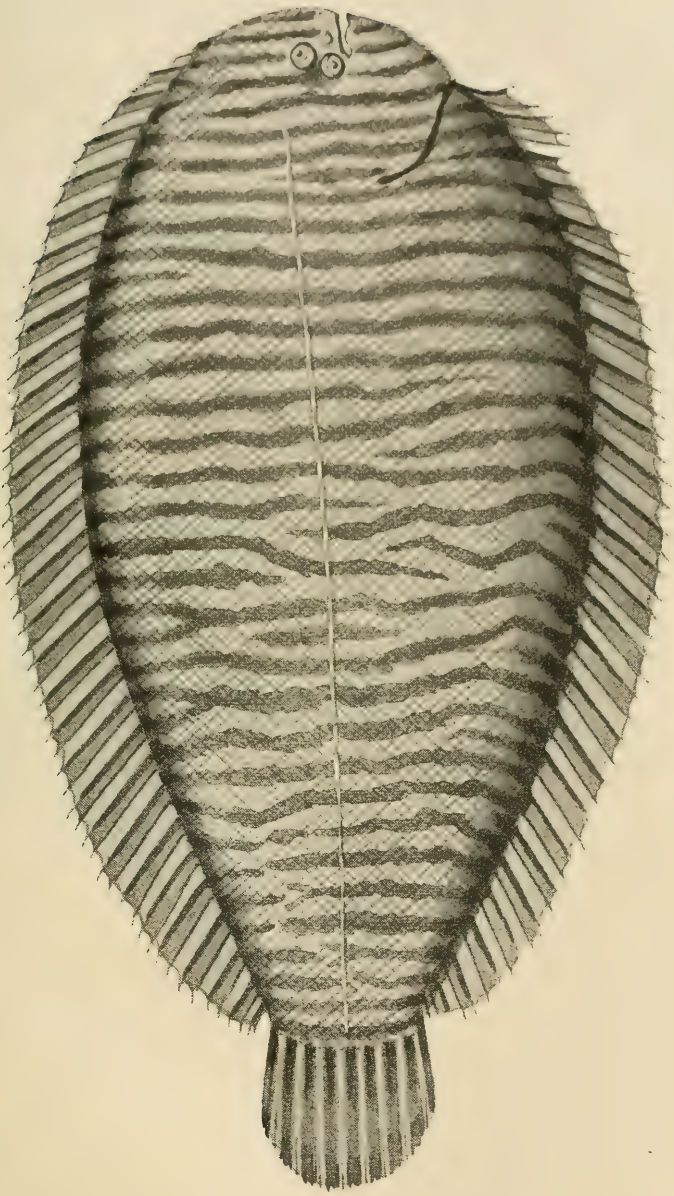


EDGAR R. WAITE, Del. AUST. MUS.

EXPLANATION OF PLATE XXIX.

Aseraggodes macleayana, Ramsay.

Natural size.

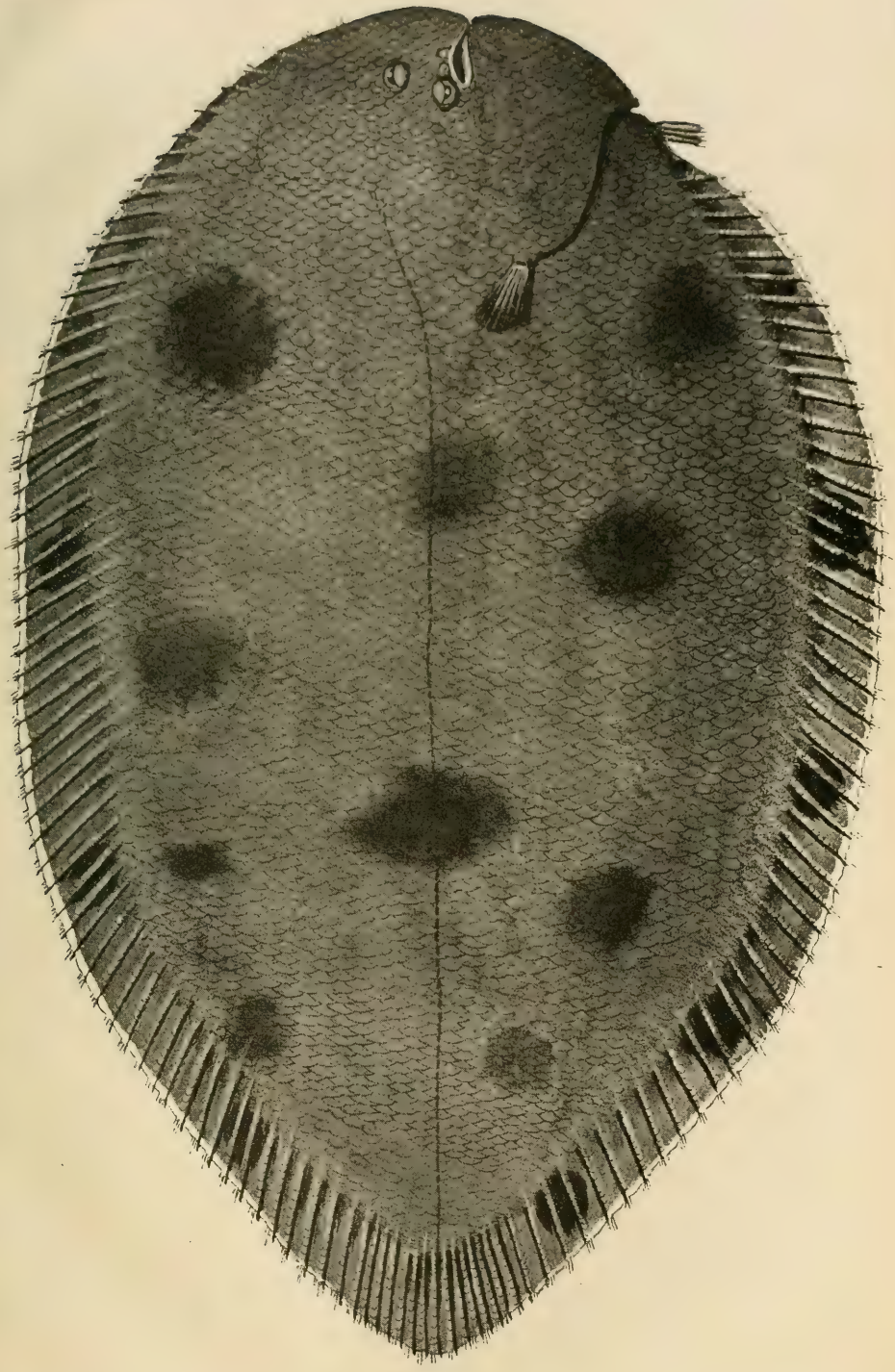


EDGAR R. WAITE, Del. AUST. MUS.

EXPLANATION OF PLATE XXX.

Synaptura nigra, Macleay.

Two-thirds natural size.

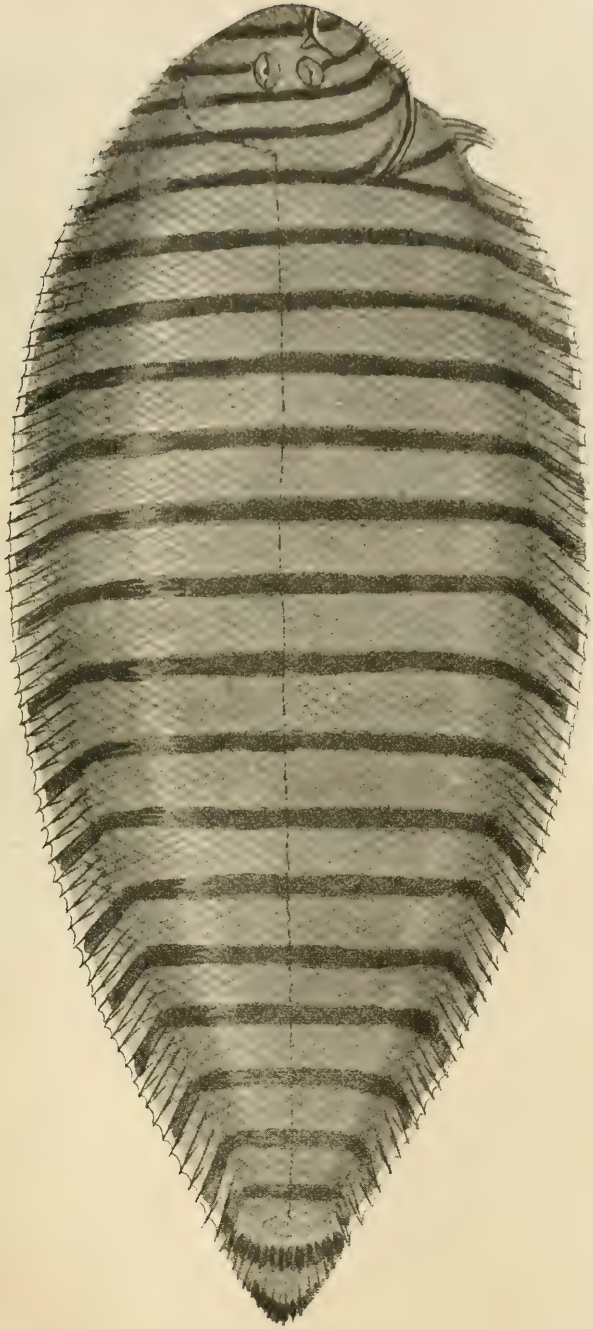


EDGAR R. WAITE, Del AUST. MUS

EXPLANATION OF PLATE XXXI.

Synaptura fasciata, Macleay.

Natural size.

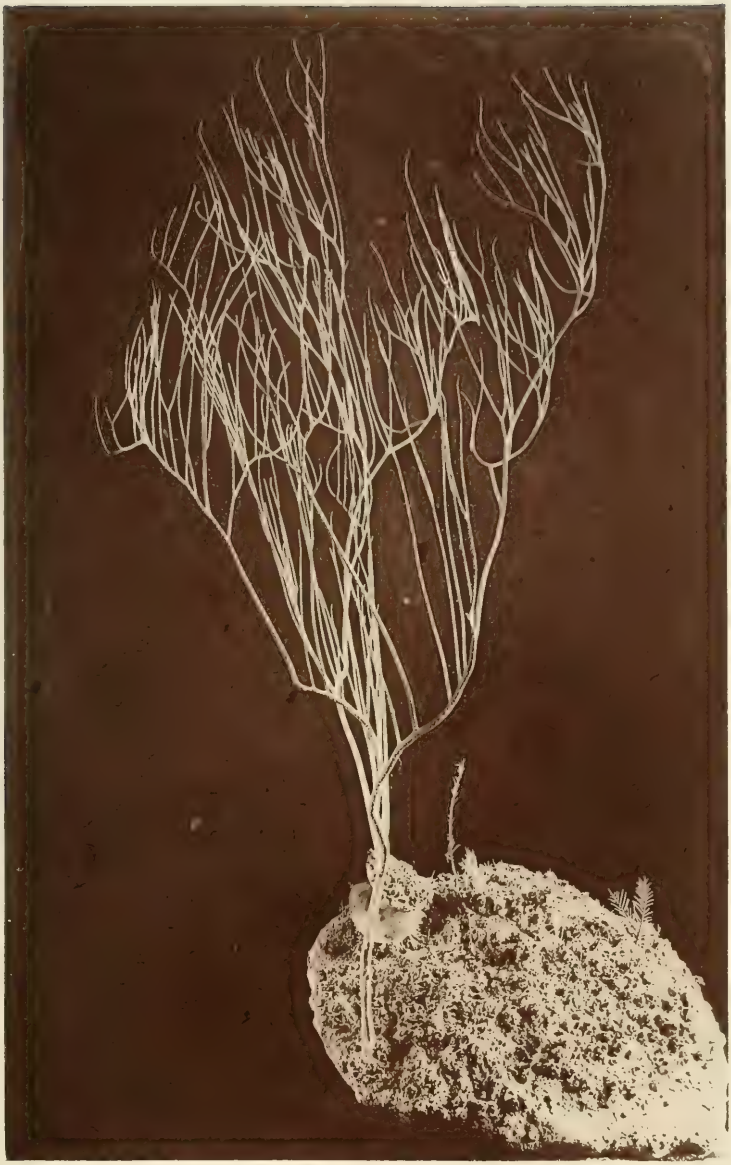


EDGAR R. WAITE, Del. AUST. MUS.

EXPLANATION OF PLATE XXXII.

Stone from Long Reef, near Manly, with attached *Gorgonia*, &c.

From a photograph by the Author. The figure has been reversed under the heliographic process.



T. WHITELEGGE, Photo.

EXPLANATION OF PLATE XXXIII.

Chlorinoides waitei, Whitelegge.

Adult male, reduced to about one-third.

From a photograph by the Author. The figure has been reversed under the heliographic process.

T. WHITELEGGE, Photo

EXPLANATION OF PLATE XXXIV.

Paramithrax tuberculatus, Whitelegge.

Fig. 1.—Adult female, slightly reduced.

Fig. 2.—Adult male, slightly reduced.

Sympagurus diogenes, Whitelegge.

Fig. 3.—Adult female, slightly reduced.

From photographs by the Author. The figures have been reversed under the heliographic process.

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T. WHITELEGGE, Photo

EXPLANATION OF PLATE XXXV.

Pilumnus australis, Whitelegge.

Figs. 1-2.—Adult males, natural size.

Fig. 3.—Adult female, natural size.

Fig. 4.—Hand of adult male, natural size.

Pugettia mosaica, Whitelegge.

Fig. 5.—Adult male, about natural size.

Fig. 6.—Side view of female, natural size.

Fig. 7.—Adult male, natural size.

From photographs by the Author. The figures have been reversed under the heliographic process.

T. WHITELEGGE, Photo.

EXPLANATION OF PLATE XXXVI.

Fig. 1.—*Cassidea turgida*, Reeve, var., from a specimen 101 mm. long. This figure is accidentally foreshortened.

Fig. 2.—*Cassidea thomsoni*, Brazier (type).

Fig. 3.—*Cassidea thomsoni*, Brazier, another specimen taken by the "Thetis."

Fig. 1.

Fig. 2.

Fig. 3.

EXPLANATION OF PLATE XXXVII.

Fusus waitei, Hedley (type).

H. BARNES, JUNR., Photo. AUSTR. MUS.

EXPLANATION OF PLATE XXXVIII.

Siphonalia maxima, Tryon.

From a specimen 240 mm. long.

H. BARNES, JUNR., Photo. AUSTR. MUS.

PLATE XXXIX.

Fig. 1.—*Megalatractus aruanus*, Linn. Blood system.

Fig. 2.—*M. aruanus*, Linn. Stomach.

Fig. 3.—*M. aruanus*, Linn. A section through the anterior part of the visceral coil.

Fig. 4.—*M aruanus*, Linn. Auricle, ventricle and fused portion of the aortæ, cut through the centre and laid back.

Fig. 5.—*M. aruanus*, Linn. Anterior view of body proper.

Fig. 6.—*M. maximus*, Tryon. Organs in the body cavity.

Fig. 7.—*M. maximus*, Tryon. Operculum.

For explanation of letters, see p. 450.

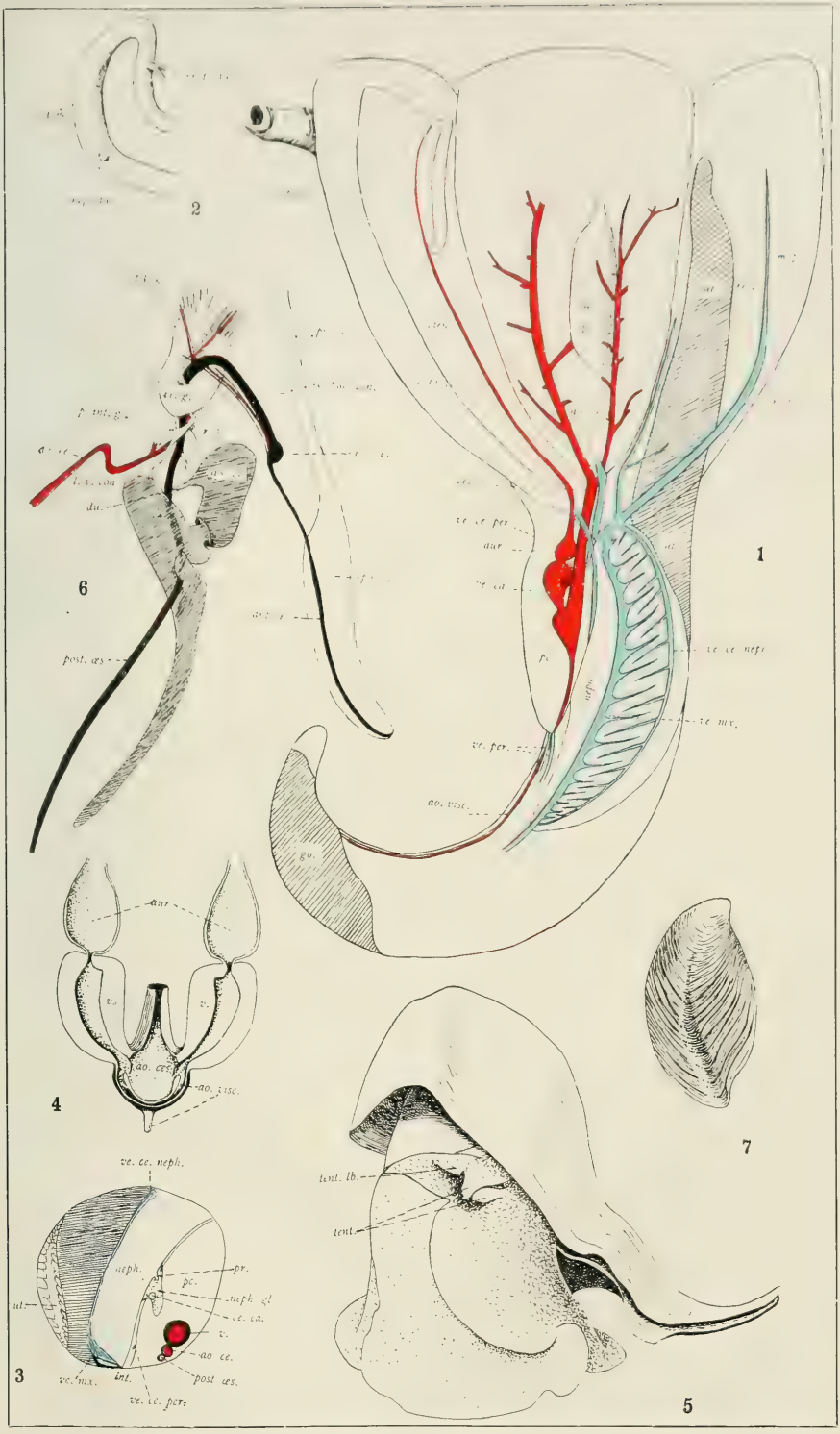
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PLATE XL.

Fig. 1.—*Megalatractus aruanus*, Linn. Operculum.

Fig. 2.—*M. maximus*, Tryon. Nervous system, as seen *in situ*.

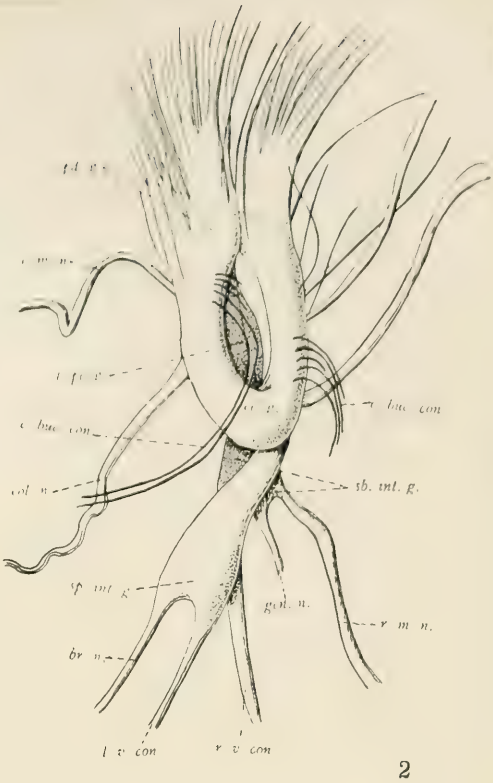
Fig. 3.—*M. maximus*, Tryon. Nervous system; the cerebral loop cut through and laid back, so as to show the ganglia below.

Fig. 4.—*M. maximus*, Tryon. Dentition.

Fig. 5.—*M. maximus*, Tryon. Dorsal view of body showing penis, and *vas-deferens*.

For explanation of letters, see p. 450.

1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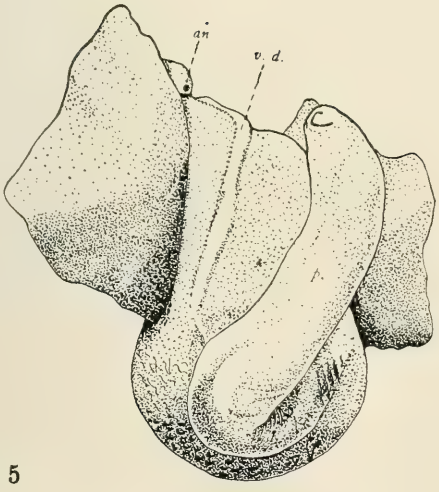
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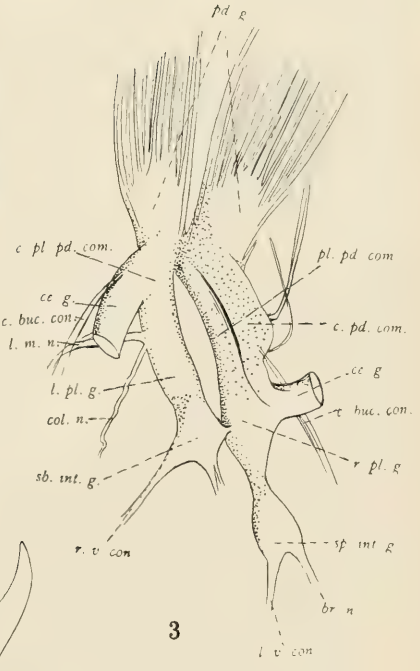
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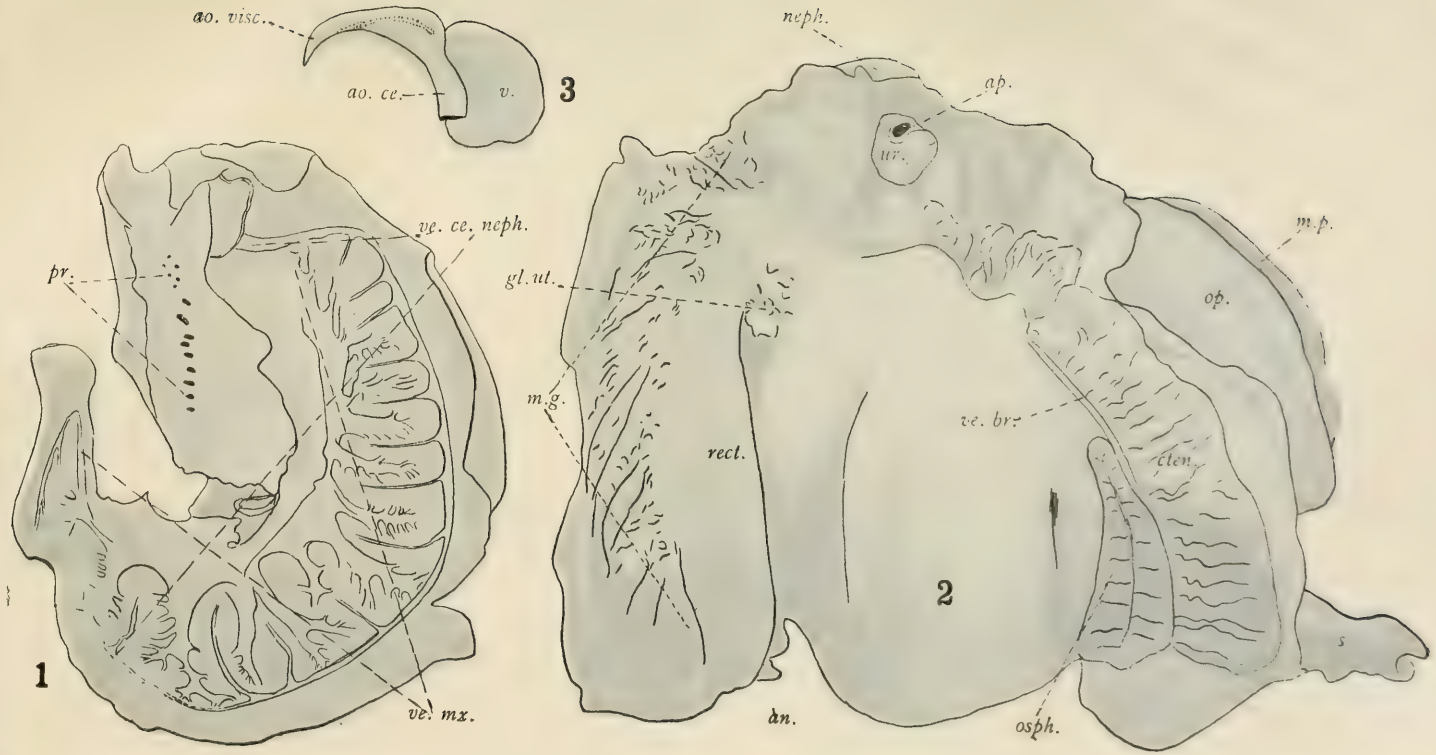
PLATE XLI.

Fig. 1.—*Megalatractus aruanus*, Linn. Nephridium laid open, showing the ramification of blood vessels on the glandular mass, and the pores of the nephridial gland.

Fig. 2.—*M. aruanus*, Linn. Pallial complex.

Fig. 3.—*M. aruanus*, Linn. Ventricle and fused portion of the aortæ. The dotted lines in the tracing show where lies the partition between the two arteries.

For explanation of letters, see p. 450.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r explanation of letters, see p. 450.

H. BARNES, JUNR., Photo. AUST. MUS.

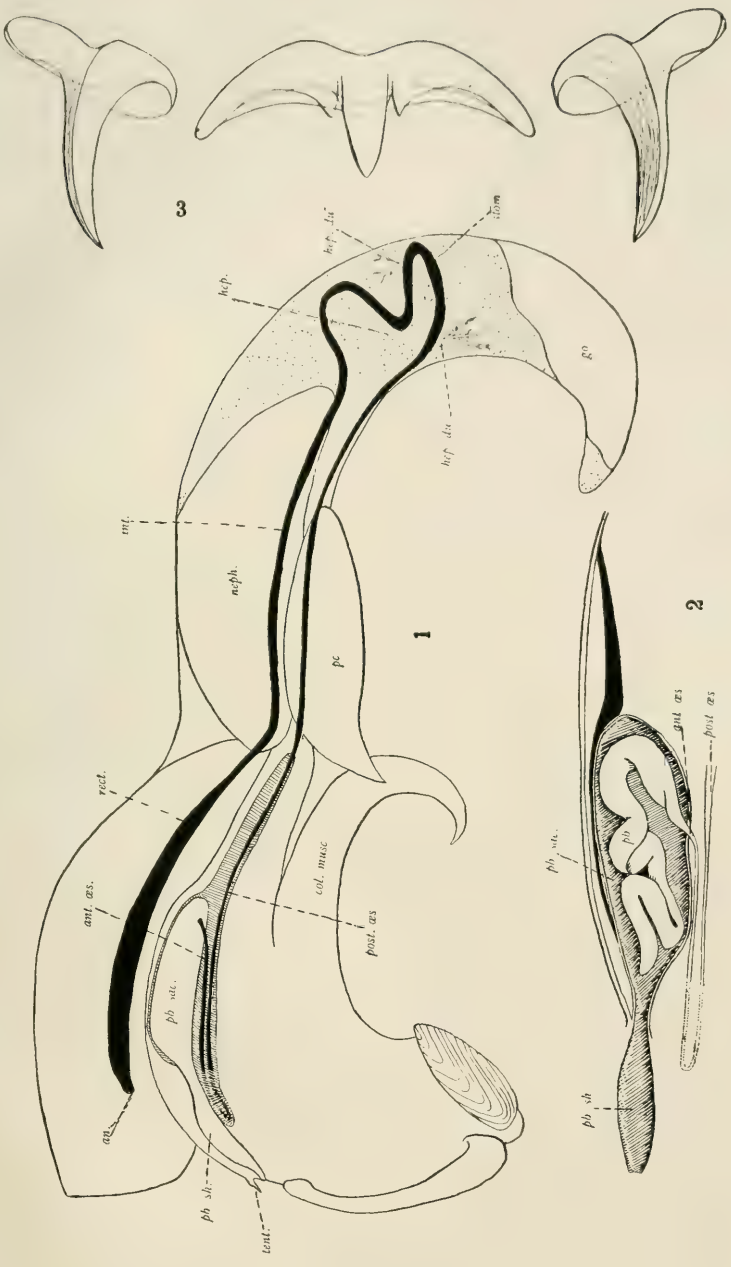
PLATE XLII.

Fig. 1.—*Megalatractus aruanus*, Linn. Digestive system.

Fig. 2.—*M. aruanus*, Linn. Proboscis lying coiled in the proboscis-sac.

Fig. 3.—*M. aruanus*, Linn. Dentition.

For explanation of letters, see p. 450.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TO

ILLUSTRATE THE TRAWLING EXPEDITION

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Manning R.

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Manning Bight

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Halliday Pt

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Cape Hawke

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32

Charlotte Head

Sugar-loaf Pt

Seal Rocks

17

Broughton I.

18

PORT STEPHENS.

Korna Pt

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Newcastle Bight

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NEWCASTLE

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Nord Head

Lake Macquarie

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Kiama

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Shoalhaven Bight

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JERVIS BAY

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